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Contractors' Topics

ENTITLEMENT TO TRADE TERMS

APPRENTICESHIP, labour relations and discounts were the leading topics discussed at this week's annual conference of the Electrical Contractors' Association. In none of these three matters is the position entirely satisfactory but in this imperfect world one must be satisfied with even partial success.

Certainly the apprenticeship scheme which was brought into operation last September is a great advance. It will inevitably be judged against the standard set by a few of the leading E.C.A. members in their dealings with their own apprentices; if it approaches that standard it will indeed achieve its aim—to ensure an adequate supply of intelligent, well-trained and qualified electricians.

Wages and Cost of Living

Labour relations will continue to be difficult until there is a change of attitude on the part of the Union. It is natural for the rising cost of living to result in persistent claims for higher wages, but until it is realized that rising prices are caused largely by the failure of labour to give full value for money things can only become progressively worse. Employees (and employers) must remember that they are pursuing a common object, satisfactory service to the public, and not regard one another as natural enemies.

The subject of discounts is one that causes trouble in most trades and industries, but it may be that there are special circumstances which make it seem particularly troublesome in the electrical industry. Ever since the passing of the 1926 Electricity Act a system of fair trading has been aimed at.

Fair Trading Policy

It was in 1936 that the Electrical Fair Trading Policy was issued and from that time the Fair Trading Council has tried to secure its general adoption. It has had a great measure of success but still, apart from the fact that many people in the various sections do not subscribe to the Policy, some of those who do are not satisfied.

Both wholesalers and contractor-retailers are not altogether pleased with the granting of discounts to large buyers and "recognized users." Then, as was made plain by Mr. L. C. Penwill in his conference paper, contractor-retailers have grievances against some wholesalers. They claim that discounts are given to all sorts of people, including some who are "illegitimately" competing with the contractors themselves.

Mr. Penwill suggested that the time

had come for a " reasonable restriction of the retail channels through which electrical merchandise is sold." His case was that only those who were prepared to give adequate technical service and guidance should be regarded as entitled to discounts. If his view that discounts are a reward for services rendered to the industry and the public is correct nobody can gainsay the soundness of his argument. It is, in fact, the essence of the Fair Trading Policy. The difficulty arises when the assessment of the value of the services of the various interests is attempted. Nevertheless there is a good deal of obvious infringement of the Policy which should be stopped.

LACK OF POWER

It is a serious matter when the chairman of the Electricity Board supplying London, still the world's greatest city, has to say that unless his Board is allowed to spend more than has been laid down it will have to refuse to connect new consumers in certain of its districts. Mr. Randall agreed that the demands upon material and labour supplies for rearmament make it impossible to secure sufficient generating and distribution equipment but he said that power cuts were seriously injuring the goodwill which the electricity supply industry had built up. He stressed the need for acquainting the public with the causes of the trouble and educating them to avoid the peaks, but that is unlikely to improve the situation very much. The only ultimate remedy is adequate plant.

METRIC SYSTEM

Although the metric system of weights and measures is 150 years old and has been since 1864 a legal alternative here to the Imperial system, it has failed to make the headway that might have been expected from its advantages. Its main field has been in laboratories and in scientific developments since that date. Thus electrical measurements tend to be in metres and mechanical engineering measurements in yards, or their derivatives. The recommendation of the Committee on Weights and Measures Legislation for abolishing the Imperial system within the next twenty years, if implemented by agreement with the Dominions and the United States, would certainly facilitate international exchange of technical information. Engineers and scientists, however, form only a small proportion of those concerned and, as Sir Hartley Shawcross has pointed out, other issues require serious consideration.

GAS-ELECTRICITY COMPARISON

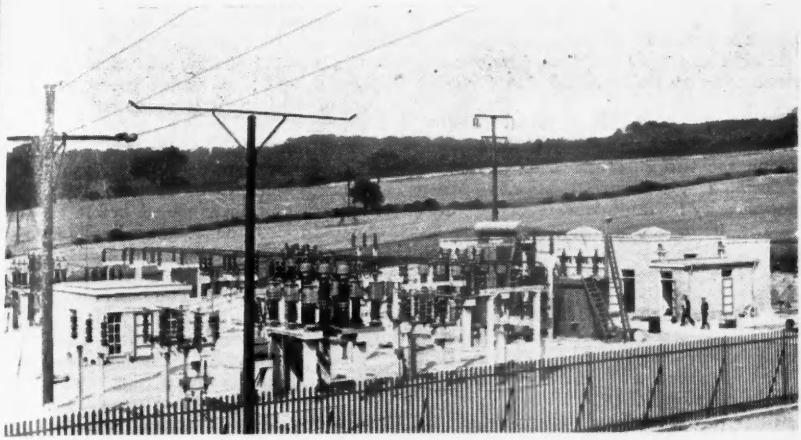
Comparisons between the gas and electricity supply industries are not so simply made as some people think and yet an attempt should be made to see how they stand in relation to one another. In this issue Mr. D. J. Bolton undertakes this task with the Gas Council's first report as a basis. He brings out very well the similarities and great differences which exist between the two industries. The comparison is of particular value at a time when there are many calls for " co-ordination "—calls which frequently reflect an incomplete study of the circumstances.

DIESEL TRACTION

Hitherto diesel locomotives in this country have been equipped with electric transmission, but a four-engined 2,000 h.p. unit now undergoing trials relies on mechanical gearing. Although operational qualities of locomotives using different fuels, including maintenance costs, can be usefully compared only by working results, the case for building an experimental engine of this size at a cost much greater than that of a steam locomotive seems, on the face of it, slight. There appears to be little chance, even under the most favourable conditions, of its extensive use, if only because oil has to be imported, whereas the diesel-electric system, in relatively small units, should have a wide field for shunting.

INSTALLATION TENDERS

We have pointed out before that if there is any price-cutting by the Electricity Boards in installation work there are few indications of it. Most of the cases we hear about tend, in fact, in the opposite direction. One instance of this was raised at a meeting of the Kensington Borough Council last week when it was said that a tender by the London Electricity Board for an installation in Council flats was 35 per cent above the lowest " private enterprise " tender, which was accepted. The chairman of the Housing Committee thought that the figures should be publicized " as it might help the London Electricity Board in future to get into line with private enterprise firms."



Barnborough Colliery

Supply Arrangements for Large Winder

DURING the early part of 1949 the National Coal Board purchased an American electric winder of modern design and high speed for installation at the Barnborough Main Colliery in South Yorkshire (variously spelt also as Barnbrough and Barnburgh). The electrical equipment is the first of its kind to be installed in this country. It comprises a 3,500 h.p. 3,000 V synchronous motor driving two directly-coupled d.c. generators, each of 1,250 kW output at 600 V. These in turn energize two 1,750 h.p., d.c. driving motors, which have a Ward-Leonard "Rototrol" system of control. This equipment has already been described in papers read before the Mining Institution by Mr. T. M. Muirhead and Messrs. Hall and Ross, N.C.B. engineers, and a description of it will shortly be published by the Association of Mining Electrical and Mechanical Engineers.

Because of the magnitude of the load and the need for security of supply, the National Coal Board approached the Yorkshire Electricity Board for a new service to the colliery. It was found necessary by the Y.E.B. to construct a new primary substation to deal with this additional supply as well as the existing colliery load and, at the same time, to provide an additional 11 kV feeding point for its own system.

The site is near the village of Barnborough approximately half a mile from the colliery and on the line of an existing 66 kV overhead feeder connecting Mexborough and Ferrybridge generating stations. The substation, as designed by the Y.E.B., is a five-switch station with provision for two further outgoing feeders. In the initial stage two feeders and two transformer circuits have been installed with provision for a busbar sectioning panel. The transformer circuits are of 15 MVA capacity, stepping down to 11 kV for the colliery and local supplies.

A building in the compound houses the complete control equipment, the 11 kV switchboard, the 415 V auxiliary switchgear, the 110 V station-battery and the

Above: **The 66 kV substation almost completed in June, 1950, with the overhead lines ready to be switched over, and the first 15 MVA transformer being installed**

fire-fighting equipment. On the opposite side of the compound a similar building contains the air compressor equipment required for pneumatic operation of the 66 kV outdoor circuit breakers.

A. Reyrolle & Co., Ltd., provided all the switchgear and associated control equipment, the two 66/11 kV transformers and associated tap-change equipment being supplied by Ferranti, Ltd.

The 66 kV switchgear comprises four 800 A type OS5 small-oil-volume circuit breakers having a making-capacity and breaking-capacity rating of 1,500 MVA at the system voltage. Each breaker consists of three single-phase units mechanically coupled by a common operating shaft. The breakers are electropneumatically operated; the necessary valves and auxiliary switches with a local control switch for maintenance are accommodated in a sheet steel cabinet mounted at one end of the circuit breaker. Other parts of the 66 kV switchgear are separately mounted post type current transformers, voltage transformers, rigid copper busbars and manually operated centre-rotating post isolators.

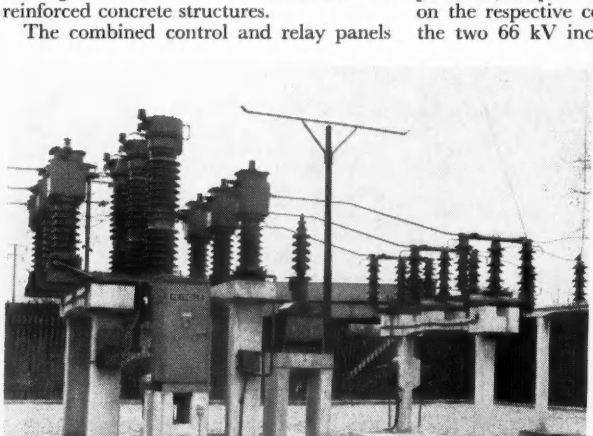
The feeder isolators are equipped with earthing blades and Castell interlocks between the various breakers and their associated isolators prevent the latter from making or breaking load current. The whole of the equipment forming the 66 kV switchgear installation is mounted on reinforced concrete structures.

The combined control and relay panels are of sheet steel cubicle construction for both the 66 kV and the 11 kV switchgear; an automatic mimic diagram is incorporated and the transformer tap-change control equipment is mounted on similar cubicles.

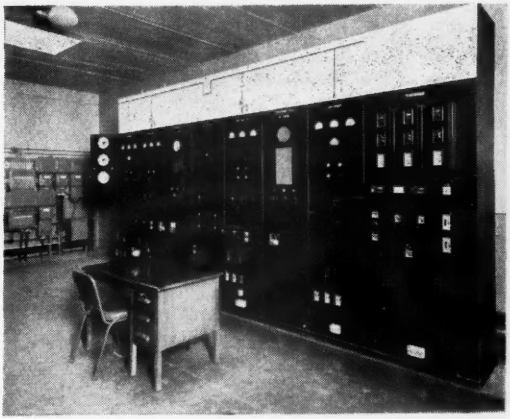
Two air cooled two-stage electrically driven compressors deliver air at 250 lb/sq in which is filtered to remove any oil or moisture and then cooled before entering the main air receiver. It is finally reduced to 125 lb/sq in and conveyed to the various circuit breaker control units on site by a ring main air line. The local air receivers on each breaker are capable of completing one break-make operation. The compressor equipment is automatically controlled, with provision for hand control if necessary, and low pressure alarms indicate failure of either one or both compressors.

The 11 kV switchgear is Reyrolle type C6T of 250 MVA, with horizontal draw-out solenoid operated oil break circuit breakers. The initial installation comprises two 1,200 A incoming transformer circuits, two 400 A outgoing feeders to Barnborough Colliery and a 1,200 A busbar section panel. Additional feeder circuits can be installed and already one has been added since the substation was commissioned.

In addition to the remote control of both the 66 kV and the 11 kV switchboards a comprehensive system of protection is provided, the protective gear being mounted on the respective control panels. Each of the two 66 kV incoming feeders has unit protection. The high-speed impedance protection of the Reyrolle ratio-balance type originally in use on the Mexborough/Ferrybridge feeder was modified to make it suitable for the Barnborough / Ferryhill feeder; "Solkor" protection was installed



One of the 66 kV 1,500 MVA small-oil-volume circuit breakers showing the local operating cabinet, post type current transformers, voltage transformer and the feeder isolator



The control and relay board for the 66 kV switchgear showing the ratio balance protective equipment on the right-hand panel

for the shorter feeder between Barnborough and Mexborough as well as for the 11 kV colliery feeders. The two 66/11 kV transformers are connected star/delta/star, with the lower voltage neutrals earthed through liquid resistors. Instantaneous balanced earth fault and I.D.M.T.L. overcurrent protection is provided for the higher voltage windings; the lower voltage windings have restricted earth fault protection and stand-by long-time-lag earth fault protection is also included.

The 66 kV busbars have Reyrolle monobias two-zone busbar protection and a three-zone scheme of leakage-to-frame apparatus protects the 11 kV busbars. The relays associated with both schemes are mounted on separate cubicles.

The 415 V station supply is obtained from two 25 kVA unit auxiliary transformers solidly connected to the 11 kV terminals of the main power transformers and protected by double float Buchholz relays while the connection to the auxiliary switchboard is protected by cartridge fuses.

The auxiliary Reyrolle "HH" switchboard is divided electrically into three sections. Each of the two end-sections is fed directly from one of the auxiliary transformers and, by means of an automatic change-over contactor, supply can be given from either transformer to the centre section which serves the essential loads in the substation. An auxiliary relay connected to the centre section gives an audible alarm if any phase of the selected supply should fail.

Since it was only possible to interrupt the Mexborough/Ferrybridge interconnector during periods of light load at week-ends, the commissioning of the substation at Barnborough was necessarily spread over several weeks and the testing and commissioning were done at week-ends. Notwithstanding this difficulty and the fact that much of the preparation of the site and of the civil work had to be done during the winter months, it is noteworthy that power was made available to Barnborough Colliery in less than 14 months after the receipt by the Yorkshire Board of the National Coal Board's initial request. Credit is also due to the N.C.B. engineers for installing and commissioning the first of the American winders shipped to this country in parts.

This first installation of small-oil-volume switchgear in the Y.E.B. area has already operated satisfactorily under fault conditions. The normal maintenance following operation did not present any difficulty to the Board's staff engineers.

Acknowledgments are due to the chairman of the Yorkshire Electricity Board, Mr. W. M. Lapper, to his chief engineer, Mr. J. D. Nicholson, and to his staff for permission to publish this article.

Indian Power Engineers

THE Society of Power Engineers was formed at Simla, India, in 1947 with a small membership as a local group, but its extension on a nationwide basis was visualized. As a step towards establishing contact with members of the profession all over India the Society is now publishing a quarterly journal, the first issue of which is a well-produced, illustrated periodical of 88 pages. Articles include descriptions of the Nangal hydro-electric project and the new Cossipore power station, other subjects being shielding overhead transmission lines; rating of circuit breakers; a note on high voltage circuit breakers; standardization of electrical plant; estimation of cost components from a composite power tariff; and career planning.

VIEWS on the NEWS

By REFLECTOR

A SECOND part has been produced for the Electrical Development Association of its coloured film " Boiling and Simmering." It was introduced into a film programme arranged in connection with last week's Sales Management Conference at Caxton Hall, Westminster. The demonstrator of the art of cooker-top cooking was Philip Harben, whose remarkable but unobtrusive showmanship makes it real entertainment. Another new E.D.A. film shown was " Electrical Terms," a companion film to " What is Electricity? ", which should be seen first. Mr. Philip Honey introduced the film with a little poem of his own which cleverly rang the changes on the terms " ampere," " volt," " ohm " and " watt " which the film sets out to explain.

* * *

In vain does the British Electricity Authority make its excuses for shortage of power plant for the lay Press knows that it is all due to sheer incompetence and indifference. Always the neglected remedy lies close at hand. For instance, John Gordon in the *Sunday Express* contends that " electricity can be generated just as successfully in open fields and wooden huts as in those wonderful buildings that are the planners' joy. (Planning is always regarded as imbecile, if not sinister.) The writer goes on:—" There are in this country scores of competent organizers who could transform the electricity situation in six months. But you can be sure that the ' It can't be done boys ' will see that they never get the chance." Of course, that is what we want—organizers, not planners.

* * *

Following up my last reference to the confusion caused by the use of the initials " B.E.A.," Mr. A. Haddock, manager of the Yorkshire Electricity Board's No. 3 sub-Area, suggests a way out. It is that the British Electricity Authority should adopt the abbreviation " B.El.A." He says that " in accordance with present-day practice, this will soon become ' Bela,' with a long ' e ' of course." I am not so sure about the long " e "; it is more probable that the B.E.A. would become " Bella " and this, together with " Eda " and " Elma," would suggest an effeminacy out of keeping with the virility of the industry.

* * *

Canada claims that by developing her water power she has saved 30 million tons of coal a year. Perhaps that is not quite the right way of putting it; if it had not been for hydro-electric development Canada would not have made so great an advance and actually would not have required that much coal. It is an interesting fact that this " saved " coal is about the same amount as we are at present using for electricity generation in this country (32·8 million tons in 1949–50). How fortunate is Canada to have what is virtually a permanent source of power while our coal reserves are being exhausted.

* * *

Radio interference is often regarded as one of those things that has to be accepted. This was not, however, the view of a listener whose experiences are referred to in the *Leicester Mercury*. After having obtained the advice of an expert who discounted the idea that a neighbour was responsible, the owner, states the report: " decided to take certain soundings in his own house. He carried a portable around till at one place close by the electric meter it played-up. . . . Next move was to summon the electricity authorities to an investigation of the meter. The result was illuminating. When the main fuse was withdrawn the lights in the house still shone." This suggests a new technique of fault location.

Gas and Electricity

Comparing the Annual Reports

By D. J. BOLTON, M.SC.(ENG.), M.I.E.E.

NOW that the first annual reports and accounts of the Gas Council and the twelve Gas Boards have been published, it is natural for electricity supply engineers to study them with a critical and comparing eye—perhaps with something of the mature and kindly superiority of a three-year-old when surveying the exploits of its younger brother. We seniors who have been nationalized a whole year longer and have already two annual reports behind us, are closely interested not only in the first year's results of the parallel service but in the method of its presentation—the reports themselves. What can we learn therefrom as regards exposition and in what ways can we justifiably feel that we have done better?

There are many possible bases for such a comparison, but rejecting (with some regret) the opportunities thus presented of being thoroughly invidious, let us compare the figures themselves and the amount and appropriateness of the information provided, with perhaps a few marginal notes on the method of presentation.

The format and total volume are the same as those of the electricity reports. In general character, the electricity reports are more technical and have more to say on engineering matters, on loads and programmes, tariffs and efficiencies.

Consider next a few numerical comparisons of the sizes and "shapes" of the two industries. In Table I the electricity figures include those for the North of Scotland, where available, and the gas figures described as "annual" are derived from the eleven months' operations of the Gas Boards by multiplying by 12/11.

The picture which emerges is of an industry with a turnover (including by-products) not much below that of the electricity industry, serving almost as many consumers and employing almost as many manual workers though considerably fewer technical and clerical. The biggest difference is in the fixed assets whose value is little more than one-third that of the electricity assets.

Sales and Revenue

Overall figures, however, are much less illuminating than comparisons in detail, since totals of similar magnitude are often very differently constituted. The next step is to make a comparison of gas and electricity sales under three different heads, namely quantities of therms or kWh, amount of revenue, and mean price. In Table II all the figures are percentages: the quantities and revenues are expressed as percentages of the totals, and the mean prices are percentages of the overall mean price (the gas figures are based on eleven months' operation and the electricity figures exclude the North of Scotland, but this will not appreciably affect the percentages).

The heavy dependence of the gas industry

TABLE I—SIZE OF INDUSTRY

	Gas	Electricity
Number of bodies	Gas Council + 12 Gas Boards	Central Authority + 15 other Electricity Boards
Number of undertakings vested	991	561
Annual net turnover, total operations	£m176 = 81% of corresponding electricity figure	
Annual turnover, gas only	£m130 = 60% " " " "	
Number of consumers	m11·87 = 92½% " " " "	
Fixed assets, written-down value	£m195 = 35% " " " "	
Personnel—		
Operatives	108,515 = 92% " " " "	
Administrative, technical and clerical	32,096 = 60% " " " "	
Total	140,611 = 82% " " " "	

TABLE II—SALES TO CONSUMERS: COMPARISON OF PERCENTAGES

Gas				Electricity			
	Therms % of total	Revenue % of total	Mean price % of overall mean		kWh % of total	Revenue % of total	Mean price % of overall mean
Prepayment (chiefly domestic)	38·5	44·1	115	Domestic and farm ..	33·4		
Quarterly, domestic and commercial ..	32·4	34·3	106	Commercial	12·2	—	—
Total, domestic and commercial ..	70·9	78·7	111	Total domestic and commercial ..	45·6	58·9	126
Industrial	26·8	19·8	74	Industrial	53·5	40·2	77
Public lighting ..	2·3	1·5	61	Public lighting ..	0·9	0·9	101
Total	100	100	100	Total	100	100	100
Mean price (i.e., revenue per unit sold) compared with 1938:	50% to 70% increase				18% increase		

on the non-industrial load is clearly shown in these figures, the percentage of revenue from industrial supplies being less than half as much as with electricity. Moreover, judging by the numbers of consumers in the different groups, this non-industrial load comes more from homes, and less from shops, offices and other establishments, than in the case of electricity. The percentage of gas consumers in domestic, commercial and industrial establishments is 94, 5 and 1 respectively as compared with the figures for electricity of 89, 9½ and 1½ per cent respectively.

Street Lighting

An interesting light is thrown by the mean-price figures on the gas industry's bid for the street lighting load. The mean price of gas for public lighting is actually less than the price for industrial supplies and only 64 per cent of the overall mean—as compared with 101 per cent in the case of electricity. Both gas and electricity Boards sell to industry at about three-quarters of their overall mean price, while domestic and commercial prices are correspondingly higher than the mean.

The Gas Council's report quotes a letter from its chairman dated 30th April, 1949, in which he says "Taking the country as a whole, the price of gas is from 50 to 70 per cent higher than it was in 1938." It is not clear, however, whether this refers to the mean revenue per therm or to price in the strict sense of the figure marked on the price ticket or in the tariff schedule, i.e., the amount paid for the self-same quantity. In the case of electricity, since most consumers are *not* just buying the same quantity as in 1938 and as most electricity tariffs operate on a sliding scale, the mean revenue per kWh tends to drop quite apart from any change in prices.

"Joint Costs"

An interesting costing problem concerns what are called "joint costs" as when a single operation such as sheep farming furnishes two major products, wool and mutton. The gas industry has an obvious problem of this kind since gas and coke, together with some lesser by-products, are produced simultaneously by the carbonizing process. Taking the total revenue of the industry from gas sales and rentals, coke, etc., sales and net revenue from apparatus sales, the revenue from coke and other by-products actually makes up 30·6 per cent of the whole, and the coke alone is 24 per cent (a slightly smaller figure is obtained if the direct charges on the coke sales are subtracted).

There is no problem of quite this kind and size in electricity supply, though it might arise if district heating from back-pressure turbo-generators developed on any scale. There is, however, a somewhat analogous problem in the sense that electricity supply has to sell two distinct products, kWh and kW of demand. The two are produced simultaneously by the same generating plant, though the proportions must depend on the character of the consumer's load, and it is sometimes economic to run one station chiefly to supply the kWh and another chiefly to supply peak kW. Joint costing of the two products becomes important when framing

off-peak tariffs, and the electrical engineer has therefore a special interest in seeing how the gas industry has met the problem.

So far as the data of the reports are concerned, the problem appears to have been not so much solved as circumvented. The "costs" of making the coke, etc. (including a proper share in the joint expenses of fuel and plant, management, etc.), are tacitly assumed to be precisely and identifiably equal to the amounts received for their sale. On this basis they can be "deducted at source" like the income tax, and everything which is left is regarded as appertaining to, and the sole concern of, the gas supply.

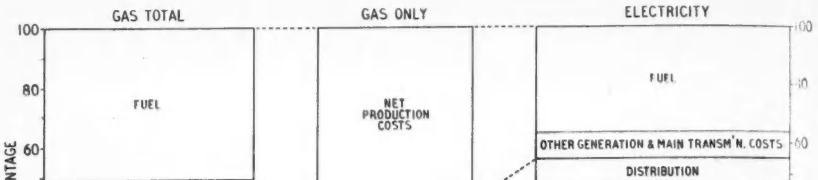
Clearly there are two entirely different ways of viewing the gas industry, namely (*a*) as a machine for the joint production of gas, coke, and a variety of minor products and (*b*) as a machine for producing gas, in the course of which certain by-products result whose sale can be offset against the cost of the raw materials consumed. Unfortunately, technical discussions are too often bedevilled by what can only be described as politics, and much harm has been done in the past by taking a strong line one way or the other in order to clinch arguments of thermal efficiency, relative economy of gas and electricity and other controversial matters.

In fact, both aspects are useful and necessary in their appropriate contexts. The gross revenue aspect is necessary because it is useless to deal with expenditure on fuel, interest and depreciation, numbers of staff, etc., except in terms of the *total* operations. A depreciation or interest charge relates to assets, many of which are used jointly to produce gas and coke. Fuel is consumed in producing gas and coke, management and establishment charges are incurred in their sale. Merely to deduct the proceeds of the coke sales from the cost of the fuel and to regard the difference as the net fuel cost of the gas is a tidy piece of arithmetic, but is otherwise quite meaningless. On the other hand, in obtaining a broad picture of the financial operations and profitability, such a procedure is a useful simplification which does not necessarily misrepresent the results of working. In Table III the method of percentages is used in order to illustrate both aspects and, incidentally, to make a comparison with electricity supply possible and illuminating.

In deciding the bases for these figures and, in particular, the percentages, the main endeavour has been to make the gas and electricity accounts as far as possible comparable. Thus, receipts from sales of gas and electricity, and from rentals of meters and apparatus, have been included in full. Receipts for apparatus which is

TABLE III—FINANCIAL RESULTS

Expenditure	GAS (11 months' figures)				ELECTRICITY (Excluding North of Scotland)		
	Total		Gas only				
	£m	%	£m	%		£m	%
Fuel	82·1	51·1	—	—	Fuel	78·3	36·7
Other works costs and gas purchased	30·6	19·0	—	—	Other works costs, purchases and main transmission	18·0	8·4
Total production cost	113·0	70·1	113·0		Total bulk-supply cost	96·3	45·1
Less net by-products sale			−42·1				
Assumed gas production cost			70·9	59·4			
Distribution and consumer service	19·3	12·0	19·3	16·2	Distribution	20·4	9·5
Administration and general charges, welfare, etc.	9·1	5·6	9·1	7·6	Administration and general charges, rents, etc.	26·3	12·3
Rates	3·2	2·0	3·2	2·7	Rates	11·8	5·5
Depreciation	8·9	5·5	8·9	7·5	Depreciation	34·3	16·1
Interest (net)	7·0	4·3	7·0	5·9	Interest	17·5	8·2
Other charges less receipts	0·8	0·5	0·8	0·7	Other charges, less receipts	−0·1	−0·1
Net surplus					Net surplus	7·2	3·4
Total	161·3	100	119·2	100	Total	213·7	100
Income							
By sales of gas	111·4	69·1	111·4	93·5	By sales of electricity	207·3	97·0
„ rentals	7·3	4·5	7·3	6·1	„ rentals	3·9	1·8
„ profits on sales of apparatus	0·5	0·3	0·5	0·4	„ profits on sales of apparatus	0·8	0·4
„ by-products (net)	42·1	26·1			„ public lighting	1·3	0·6
					„ sales of steam	0·4	0·2
Total	161·3	100	119·2	100	Total	213·7	100



Allocation of annual revenue

sold in the same form as purchased, have, in both cases, only been included in the form of the net profit on such sales. A moot point arises on the by-product sales when dealing with the gas industry total. In this case certain direct charges on these sales (at works and in selling) have been deducted and only the net income has been included.

The money figures are not quite directly comparable, since the gas totals refer to eleven months' operation whilst the electricity totals omit the North of Scotland. These omissions on the two sides to some extent cancel out and do not prevent broad comparisons being drawn. Moreover, the percentages would hardly be different if both sets of figures were complete. (The inclusion of the North of Scotland would slightly affect the fuel percentage, and there are some advantages in confining the comparison to (substantially) a single form of generation.)

Cost Comparisons

Comparing results, fuel represents a considerably larger cost with gas than with electricity, and the total works cost of production of gas, even if the by-product sales are deducted therefrom, equals nearly 60 per cent of the gas turnover, whereas electricity generation and main transmission costs are only 45 per cent. Distribution and consumer-service costs, rather surprisingly, exceed those of electricity, but the overheads are much less under each of the four heads—administration, rates, depreciation and interest. For example, the percentage amount paid in (or in lieu of) rates is half or less than half of the electricity figure. So far as capital charges are concerned, the differences are to some extent explained by the figures already given for value of assets.

The diagram illustrates the above comparison on both the " total " and the " gas only " basis. The three columns are all of the same height, to show the proportions on a common percentage basis, while the different magnitudes are shown by the differences in breadth. In these diagrams the gas magnitudes are increased in the ratio 12/11 so as to represent a whole year, and the electricity figures are increased slightly to represent the addition of the North of Scotland.

A somewhat similar diagram on page 173 of the Gas Council's report analyses the selling price of gas and shows by percentages how the costs are proportioned on the " gas only " basis (second column of above table). Some of these percentages are, however, somewhat misleading, at least to an outsider. Not only is the revenue from by-product sales deducted from the gas production cost, but the revenue from meter and other rentals (amounting to 7 per cent of the total gas revenue) is deducted from the cost of distribution and consumer service. The latter is therefore shown as 10·3 per cent of the whole, whereas it would be 16·2 per cent if expressed on the same basis as that used in the electricity accounts.

Changes in the opposite direction result from confining the assessment to the gas

side only. Thus depreciation and amounts written off, much of which must relate to plant jointly involved in gas and coke production, appear as 8 per cent of the gas revenue whereas they form only 5½ per cent of the total revenue. Leaving aside the major question of the by-products one would imagine that the business of renting meters, for example, must involve expenses under the general heads of administration, welfare, etc., and its omission from both sides of the account is bound to distort the proportions of what remain. In the case of the by-products it is possible that the "direct charges" offset against their sales do in fact include appropriate contributions to these general charges, and possibly even some allocation of capital charges, though in this case it would be very interesting to learn on what basis this has been done.

Depreciation Provision

There are many other questions which one would like to ask, some of them—e.g., those concerning depreciation provision—probably unanswerable even by those in the industry, owing to lack of data regarding the vested assets. Essentially these resolve into a single comprehensive query: is the depreciation provision adequate to replace the first cost of the plant by the time its useful life has expired? That it is not adequate to cover replacement cost is fully admitted, and here the gas and electricity industries are in the same position.

The policy on depreciation provision can be summarized as follows: Whereas the vested undertakings frequently operated on a renewals basis, the Gas Boards are to set aside precise depreciation provision for all fixed assets on a straight-line basis for their estimated useful lives. A committee was moreover set up to recommend suitable rates for this purpose in the case of all post-vesting assets. (So far the parallel with electricity is very close.) In order to provide the opening entries for the pre-vesting assets, the Gas Boards decided to adopt net book values as these stood in the accounts of the vested undertakings, which will in general be the written-down value or the first cost less the accumulated depreciation reserve. Where it is impossible to assess the written-down value, depreciation provision on pre-vesting assets is to be based on the estimated remaining serviceability. In the case of former local authority undertakings the remaining loan periods provide the necessary guide to this, but the gas industry inherited a much smaller proportion of such undertakings than did the electricity industry.

Some light is thrown on the probable treatment of the fixed assets of pre-vesting company undertakings by a note in the North Thames Gas Board report. Buildings, works and plant are to be depreciated to nil in 30 years from vesting day, mains and services to nil in 40 years, and so on. Since on the average the plant must be presumed to be already nearly half time-expired, this seems to assume unduly optimistic lives for plant and equipment. A rough overall comparison with electricity is provided by the fact that the depreciation provision of the gas industry works out at about 4·7 per cent of the written-down value of the fixed assets as against 6·2 per cent in the case of the electricity assets. Both figures would be something over half this if expressed as a percentage of the first cost, and they point to a mean expectation of life of some 50 years for new gas plant. Those who take a less rosy view of the industry's future prospects will doubtless hint at the advisability of some provision for obsolescence !

Load Fluctuations

The "peak load problem" makes little showing in the gas reports. Daily load fluctuations are taken care of by the gas-holders, and the only remaining difficulties in this kind are the effects of extended cold periods and the seasonal variations. (The supreme facility of the gas industry at moments of crisis—that of an almost unlimited capacity for pressure reduction without actual disconnection—is tactfully not referred to.)

As regards seasonal variations, a graph is shown on p. 166 of the Gas Council's report plotting gas availability throughout the year, and a largely parallel graph shows outdoor temperatures to an inverted scale. The curve is closely similar to the curve of electricity demand on page 191 of the B.E.A. report. It is true that the gas curve refers to quantities and the electricity one to maximum demands but, since the daily load factor is fairly constant, the comparison is a valid one. What may be called the "trough ratio"—the difference between the lowest summer value and the highest winter value, divided by the

latter—comes to about 35 per cent in both cases when allowance has been made for the yearly rate of growth. This seems to suggest that the gas demand has a seasonal variation not greatly different from that of electricity.

Finally, a note on presentation. The Gas Boards in their reports have a very similar task to that of the Area Electricity Boards, but the task of the Gas Council is much simpler than that of the B.E.A. It has, it is true, to collect and correlate the statistics of the separate Boards, but it has no large-scale activity of its own to report upon. It is for this reason perhaps that it gives the impression, almost, of over-simplification. The first report of the B.E.A. was, inevitably, a lengthy and complex production, and an index was called for—a call that was promptly answered when the second report was made. The Gas Council's report is much shorter and (though not provided with an index) this writer, at least, experienced no difficulty in finding his way about and has nothing but praise for its arrangement and editing.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Electrical Vector Diagrams

MAY I reply briefly to Mr. Lyon's latest letter (11th May) on this subject?

Mr. Lyon objects to the necessity when using the "fall" convention of reversing the direction of voltage vectors when considering the internal voltages of generators, i.e., of writing $E_{ab} = -V_{ab}$. This, however, seems to be quite logical, since the two voltages are acting in opposite directions *relative to the two terminals a and b*. The external voltage, V_{ab}, acts so as to drive a current *in the external circuit* from a to b, whereas the internal voltage, E_{ab}, acts so as to drive a current *in the internal circuit* from b to a. The same considerations would apply when using the "rise" convention.

One further point: Mr. Lyon is prepared to accept my suggested notation for current vectors and it seems a little strange, therefore, that he should agree to the use of two opposed conventions, one for current vectors and one for voltage vectors. This surely would create considerable confusion, since both current and voltage vectors appear in the same diagram not infrequently. I would prefer to apply the same convention to both current and voltage vectors and face the much more infrequent necessity of saying that $E_{ab} = -V_{ab}$ (which in any case is quite logical, as I have shown).

I would stress again that I am not championing the "fall" convention *per se*; I am supporting a method of labelling vectors which provides a convenient association of vector nomenclature and circuit nomenclature, and which, incidentally, happens to coincide in many instances with the "fall" convention that Mr. Lyon so vehemently opposes.

In my first letter on this subject I stated that there was little to choose, on purely technical grounds, between the "rise" and "fall" conventions and advanced my suggested method of nomenclature as an alternative viewpoint. In his criticisms, therefore, Mr. Lyon should bear in mind the basis of the method, namely circuit associations, and not apply to it criticisms that are appropriate to the "fall" convention primarily because of its basic conception.

The first thing is to choose your convention and state it; the second is to stick to it.

Hebburn,
Co. Durham.

RALPH K. EDGLEY.

Human Values in Nationalized Electricity

I AGREE whole-heartedly with "Fiat Justitia" (your issue of 18th May) that there are many anomalies in the payment of B.E.A. staff, but I doubt whether your correspondent's letter makes any serious contribution either to their enumeration or elimination. His main complaint is that someone whom he chooses to call a "clerk" in his thirties is to be given £1,250 a year,

whereas most of the experienced and qualified engineers in the supply industry cannot hope to achieve such a salary by the end of their careers. Arising from this, his secondary complaint is that the B.E.A. and Area Boards fail to evaluate correctly "human service within the industry." His implied complaint is that engineers are underpaid.

This implied complaint is almost too well known to require stating afresh, but it should be noted that engineers are not underpaid because "clerks" are overpaid. Presumably your correspondent would be quite happy with present salaries if only "clerks" received less.

It is rather unfair to ask a nationalized industry to "evaluate human service" and pay accordingly, for, apart from the utter impossibility of so doing, no other industry has ever attempted it. By and large, industry pays its staff the lowest salaries which can retain a sufficiently continuous service, the actual values for each category being influenced by trade union organization as well as by individual reactions which are of course in turn conditioned by national and international economic forces.

Engineers have consistently ignored this fact and I think it probable that the reason for their anomalous position in relation to the "clerks" will be found in the engineer's own attitude towards his profession, especially as it is expressed in a timid and therefore only partially successful trade union. The engineer is too apt to preen himself in contemplation of his rare knowledge and qualifications and to expect his employer to pay him in accordance with this self-estimation. The sooner he learns to devote more effort towards making his trade union as good as the one which makes it possible for the "clerk" to achieve a salary of £1,250 in his thirties, the sooner will your correspondent have his pride restored and find himself in receipt of a salary commensurate with his responsibilities.

B.E.A. ENGINEER.

THE appointment of administrative staff at enhanced salaries is giving cause for the greatest concern among responsible engineers in the industry, and a casual scrutiny of your "Situations Vacant" columns will show many advertisements for well-qualified technical men who are required to accept considerable responsibilities for salaries of £400 to £500.

It would be interesting to have some figures, if the British Electricity Authority would dare to supply them, of the comparative growths of administrative and technical staffs in the electricity supply industry during the three years which have elapsed since nationalization. Certainly, we engineers feel that the remuneration of administrative workers is entirely disproportionate to their contribution to the progress and efficiency of the industry, and it may be of interest to other engineers to know that the Birmingham Section of the E.P.E.A. passed a resolution a few months ago calling for an immediate comparison of salaries paid to engineers with those paid to secretarial and accountancy staffs, and for action to redress the gross inequalities which exist.

"POOR RELATION."

Domestic Water Heating

MR. BAYFORD BENNETT'S suggested method for improved control of a combined coal/electric water heating installation (11th May) is interesting and ingenious.

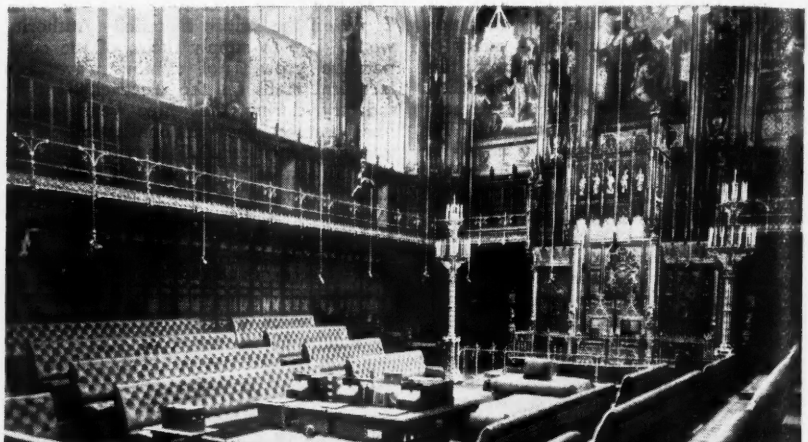
My own experience showed the need for something better than leaving the immersion heater on circuit under thermostatic control when my solid fuel boiler (used also for space heating) was in use.

Readings showed that almost as much electricity was used to boost the solid fuel system as was used when the boiler was not in service. The solution adopted was to fit a sink heater and cease using the immersion heater when the boiler was alight. This not only eliminated losses due to the dead leg from the storage vessel—losses that are often greater than most people imagine—but did away with the necessity of keeping the solid fuel system at 140 deg F, or over, for the sake of the sink tap, a procedure that often leads to excessive space heating and waste of solid fuel.

It is a simple method that avoids the necessity for relatively complicated controls; it makes a very flexible installation and should, in my opinion, be far more widely adopted than it is at present.

London, W.C.2. E. M. ACKERY.

Television Relay Services.—Eastbourne Town Council has given the Highways Committee authority to negotiate for a radio and television relay service for the town. A similar scheme is planned at Dover.



House of Lords

Electrical Installation Improvements in Restoration Scheme

THE reinstatement of the House of Lords after extensive bomb damage in 1941 has provided the occasion for the renewal of practically the whole of the wiring installation, the improvement of the lighting and the provision of a modern sound amplification system. The improvement of the ventilation by the installation of an air conditioning system is also planned but has been postponed for the present for reasons of economy.

Improvements in the standards of illumination in the Chamber have been achieved by increasing the intensities from existing fittings, still using tungsten lamps, rather than by any major changes in the methods or principles of lighting. The ten original corona pendant fittings designed by Pugin for gas lighting have been retained. These fittings, which were adapted for electric lighting many years ago using bare lamps, have now again been modified, without destroying the character of the design, to introduce illumination of the ceiling in addition to an increase in downward lighting. This not only reveals the fine detail of the ceiling decoration which hitherto has remained unseen, but also eliminates the dark background against which the fittings are viewed.

The new arrangement also produces more comfortable conditions, apart from giving a brighter appearance generally to the Chamber. The indirect lighting has been accomplished by filling in the open base of the fittings with polished brass panels, which form a trumpet-shaped reflector containing three 200 W lamps, not visible from below. The downward lighting consists of six prismatic glass reflectors (with one 150 W lamp in each) on each fitting, suspended from the angles of the hexagon-shaped corona. For the purpose of cleaning and re-lamping, these main

fittings are suspended on a counter-weighted pulley system, with the electric cable fed from a spring loaded coiling drum.

For the lighting of six large frescoes, which lie in recesses, specially designed reflectors using tungsten tubular lamps are mounted vertically behind panel mouldings at the sides. The illumination of the Lords Lobby and Princes' Chamber has been improved, also by modifying the original fittings to introduce indirect ceiling illumination and by the use of prismatic reflectors for downward lighting. New hexagonal ceiling fittings constructed of polished brass have been fixed in the east and west division lobbies in place of the original gas fittings. Eleven clocks in the Chamber and adjoining rooms have been converted to the electric impulse type and wired back to the master clock in the basement.

The rewiring installation has been necessitated by the greater load to be carried. Additional wiring has been installed for battery operated emergency lighting in the Chamber, lobbies, principal rooms, and at all points necessary to allow movement in and out of the Chamber during failure of the main supply. In general, the wiring is carried out in 660 V grade v.i.r. cable in galvanized steel conduit, with mineral insulated copper sheathed cable used in constricted positions.

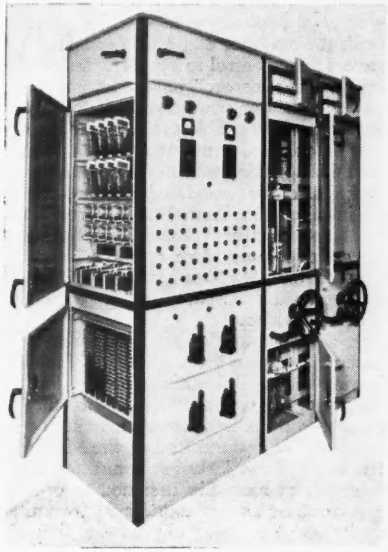
Control System

The complete lighting installation is controlled from one main panel. The illumination intensities in the Chamber and on the frescoes are adjusted by push-button operated motorized dimmers built into this panel. The dimmers are built in two halves, one 12 kW bank for the general lighting and one 9 kW bank for the ceiling floodlights and the frescoes. Light meters are incorporated in the dimmer panels to indicate the intensity of the Chamber lighting at any point over the range of adjustment. This main control panel houses also the main incoming switches, sub-main switches for the dimmers, local switches for the control of all lighting points in the Chamber, division lobbies, and adjoining rooms.

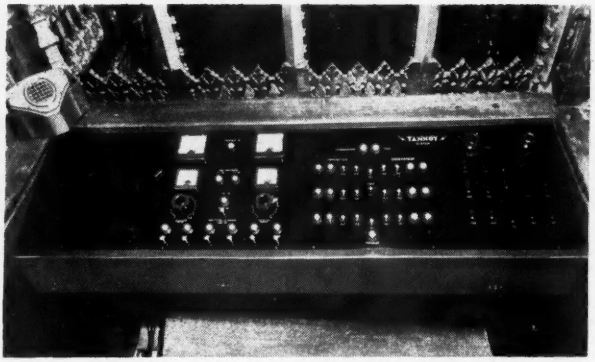
Distant reading thermometers have been installed in the Chamber, division lobbies, Princes' Chamber and Lords Lobby. These thermometer points are wired back to a multi-position switch on the main electrical control panel, where the selection of the appropriate thermometer station on the multi-position switch gives a direct reading of temperature at that station.

The new speech reinforcement service in the Lords Chamber is similar to that in the new Commons. Approximately 320 miniature voice reproducer units, each operated at a low level of sound intensity, are accommodated in the seating or adjacent thereto throughout the Chamber. These units are so connected as to operate in zones. Unidirectional microphones are associated with these zones, enabling any Member to speak wherever he may stand and be clearly heard in all parts of the House.

Fourteen microphones are suspended in the Chamber: six on each side over the benches, one over the Woolsack and one over the cross-benches. A special bi-directional microphone is situated on the Table of the House. Normally, only one microphone will be in operation at any time. The voice reproducer units in the zone of the particular microphone will be muted, while those units in adjacent zones will be partially attenuated. The loudness levels of the various zones are adjustable on the main amplifying equipment, while the



Lighting switchboard with motor driven dimmer



Public address control panel showing the microphone selection and monitoring facilities

selection of the degree of attenuation associated with the microphone controls is achieved by relays interconnected with the microphone switches.

A control panel is installed in the end gallery to the right of the Throne. From this position the operator has an unobstructed view of the Chamber. The centre of the control panel incorporates a diagrammatic plan of the floor with electrically latched push-button switches and indicator lamps, so that when a Member rises to speak the operator can quickly identify the correct push-control to operate. Subsidiary units in the control panel accommodate output indicator meters and all the necessary controls to enable the equipment to be fully monitored and remotely operated from this position, since the main amplifying equipment and associated power supplies are installed in a vault beneath the Chamber. For Members' benches and seats in the galleries, one voice reproducer unit is installed for each two seats. For each of the Press seats a separate voice reproducer unit is provided.

In addition to the general speech reinforcement service for the entire Chamber, hearing aid facilities are provided for the Members, an outlet jack for a suitable hearing aid being provided adjacent to each voice reproducer unit on the Members' benches. These jacks are connected to an independent amplifier designed to operate at a constant level of sound and not muted or zoned. The voice reproducer units in the Press seats and the galleries will also operate from an independent attenuator control to enable maximum power level to be obtained, and will function continuously. These, too, will not be muted or zoned.

The main amplifying and control equipment is installed in totally-enclosed cabinet-type racks which, in addition to accommodating the control units mentioned above, include sixteen microphone pre-amplifiers, two buffer amplifiers and three power amplifiers. The latter two units are self-contained and designed to operate from a standard a.c. mains supply. The pre-amplifier units each comprise a three-stage amplifier with independent volume and tone controls to enable the overall frequency response and amplification for each microphone circuit to be individually adjusted. These pre-amplifier units obtain their h.v. and l.v. currents from common supply units in duplicate. The filament current is obtained from l.v. metal rectifiers.

Among the contractors concerned with the scheme were: Troughton & Young, Ltd. (main contractor for electrical installation including modernization of the lighting); Micklewright, Ltd. (control panel, including dimmer panels), Escaré Art Metal Co., Ltd. (new lighting fittings), Negretti & Zambra, Ltd. (distant reading thermometers), Chloride Electrical Storage Co., Ltd. (emergency lighting battery), Walsall Conduits, Ltd. (conduit and fittings), Enfield Cables, Ltd. (v.i.r. cables), Pyrotenax, Ltd. (mineral insulated cables), London Electric Firm (cable drums for ceiling fittings) and Sound Rentals (Tannoy Products), Ltd. (sound amplification).

National Radio Show

RADIO, television, radar and electronic equipment, which British manufacturers are exporting to the value of nearly £18 million a year, is reviewed in a 28-page booklet published by the Radio Industry Council for circulation overseas in connection with the next National Radio Show at Earls Court, London, from 28th August to 8th September.

Research at the N.P.L.

Jubilee Celebrations and Open Days

In order to provide interested engineers and physicists with an opportunity of familiarizing themselves with the research and development work which is being carried out at the National Physical Laboratory under the directorship of Dr. E. C. Bullard, F.R.S., six days were assigned to the annual visit. This year's programme has been unusually comprehensive and in view of the Festival of Britain the jubilee celebrations of the Laboratory, which had been postponed from last year, were held at the same time as the visit.

To mark the occasion an attractively produced 104-page book has been issued which tells the full story of the N.P.L., how it all began, its organization, the maintenance of standards, research, special investigations and testing and possible future fields of activity. Written by John Langdon-Davies, this profusely illustrated book is available from H.M. Stationery Office, price 4s.

Standardization Symposium

On Monday and Tuesday of last week, before the laboratory was open to visitors, an international symposium on standards was held. Representatives of all the national standardizing laboratories throughout the world attended and although no conclusions were reached the symposium served a most useful purpose as individual participants were able to give their personal views and in this way a fuller understanding of the other man's point of view was promoted. Among the many subjects discussed was the standardization of radioactive isotopes.

The inspection of the laboratories by the General Board took place on Wednesday and members of university staffs and Government Departments were afforded the opportunity of attending on Thursday. On Friday afternoon, for the first time, representatives of local organizations were invited, while on Saturday the staff were "at home" to their friends and families. The representatives of industrial organizations were invited on Monday and Tuesday of this week.

The work of the Laboratory is conducted in ten divisions, each of which had arranged exhibits and demonstrations to a total of 382.

Measuring Short Distances

In the Electricity Division measurements are being made of the refractive index of air in connection with investigations into the possibility of employing the interferometry of radio waves as a means of measuring short distances. The measurements have been made at a wavelength of 1·25 cm with an accuracy comparable with that of optical determinations made before the war. The method is based on the change in natural frequencies of a cavity resonator when filled with air and when evacuated. High accuracy is achieved by connecting the resonator in a waveguide bridge circuit giving great sensitivity, and by measuring the frequencies directly in terms of the standard quartz clock with a precision of one part in 10^8.

The results obtained separately for dry air and water vapour are incorporated in a formula from which the refractive index for any specified atmospheric conditions can be calculated. The value which has generally been used hitherto is found to be about four parts in a million too high.

Dielectric Properties

There has for some time been a need for apparatus that will measure the dielectric properties of liquids and solids in the region of 500 Mc/s on samples that are convenient for industrial production and as similar as possible to those used for standard methods at other frequencies. Apparatus for this purpose has been devised and measurements at different frequencies are made by using samples of different thicknesses. Liquids are placed in a shallow

polythene cup and then tested in the same way as solids, due allowance being made for the cup. Measurements of the power factor of good dielectrics can be made to an accuracy of $\pm 2 \times 10^{-5}$. Measurements on a variety of samples have established the method as one of high precision with a wide range of application.

In the Radio Division investigations are being made into the dielectric properties of water in connection with a study of radio wave propagation. Intensive studies have been made on centimetre and millimetre wavelengths and apart from their bearing on the study of wave propagation observations on these very short wavelengths are of particular interest since they are in the region of maximum dispersion of dielectric constant resulting from the polar nature of the water molecule.

The effect of dissolved salt has also been investigated and to facilitate the study of dielectric dispersion in pure polar liquids some additional measurements have been made on methyl and ethyl alcohols.

An interesting photoelectric template colorimeter employing a double spectroscope with a single prism has been developed in the Light Division. A variable template is placed in the plane of the spectrum and is adjusted to make the response of the combined spectroscope and photocell match that of the average human eye. Colours are thus measured as they would be with an ordinary trichromatic colorimeter and a human observer only with more accuracy and precision.

Checking Qualities of Metals

Precision measurements of the velocity of ultrasonic waves through metals are being used to determine the effect of adding foreign atoms in controlled amounts to various pure metals; similar measurements may also lead to methods of checking qualities of industrial metals as a routine operation. Very precise electronic timing gear has been developed in the Physics Division, together with methods of launching the waves in small specimens. For a rod of tool steel an inch long, for example, the travel time of a short wave pulse frequency, perhaps 15 Mc/s, will be a few millionths of a second and this time can now be measured with an accuracy of about 2×10^{-9} sec.

In the new X-ray laboratory of the Physics Division a Van de Graaff X-ray generator has been installed. It is of a compact design in which the X-ray tube, together with the high potential generating device, is enclosed in a pressure vessel at about 20 atmospheres, thus reducing the spark-over distance at two million volts to manageable proportions. At full power the X-ray output is roughly equivalent to the gamma-ray emission from 10 lb of radium. The Laboratory maintains the standard of X-ray intensity on which the doses administered in hospitals in X-ray therapy, and the measurement of the hazards to workers from high energy radiation, ultimately depend. As the use of high energies becomes more widespread, so the difficulties of precise measurement increase, and the purpose of this installation is to allow the many problems of scattering, absorption and measurement of X-rays at high energies to be investigated more fully.

Electronic Simulator

The calculation of the transient response of an automatic control system is usually too lengthy a process to justify its use in design or synthesis. To enable the transient response to be obtained rapidly, an electronic simulator is being developed in the Metrology Division. This is a machine which sets up the analogue of a control system of any physical type, in terms of electrical networks and electronic amplifiers. It consists of independent units, analogous to the various parts of a control system (either in the plant or the controller) which can be connected, by means of telephone plugs and jacks, in any desired sequence. The simulator is of the repetitive type: a square-wave generator simulates a repeated step input function, and the repeated response of the system is shown as a steady trace on an oscillograph screen. In the present stage of development the machine is capable of dealing with high order, single loop, linear systems, which can comprise up to six exponential time-constants, a distance-velocity lag or dead-time, two integrations and a phase-advance network. Tests have been made which prove the reliability and accuracy of the simulator in its linear form, and further development is being directed towards the inclusion of non-linear units. The first of these, a unit to simulate the " on-off " type of controller, is now in the prototype stage.

Royal Society Soirée

Exhibits at the Annual Conversazione

RECENT discoveries and fresh methods of investigation in twenty branches of science were illustrated by thirty-one exhibits at the annual conversazione of the Royal Society (president: Prof. E. D. Adrian) last week at Burlington House, Piccadilly.

The essence of these exhibits is that they are, as far as possible, transported parts of university, government and industrial laboratories. As is customary some 250 science scholars inspected the display on the morning after the soirée.

Artificial Crystals

Two distinct methods for the hydrothermal synthesis of large quartz crystals, which are a valuable substitute for the natural mineral used in the manufacture of piezo-electric oscillators for telecommunications circuits, have been employed by Messrs. C. S. Brown, R. C. Kell and L. A. Thomas (G.E.C. research laboratories) and Drs. W. A. Wooster and Nora Wooster (Brooklyn Crystallographic Laboratory, Cambridge). Such "artificial" crystals examined by quite critical methods in Prof. G. I. Finch's laboratory have exhibited better properties than any he has found in the natural substance.

In both methods a pressure of about 100 atmospheres is created within the growth chamber by thermal compression of an aqueous solution at about its critical temperature. In addition, a temperature gradient is maintained in the preferred method, which enables crystals weighing about 100 grams to be grown in from 10 to 28 days.

Dauphiné electrical twinning that often occurs in natural quartz can be created, modified, or, in some cases, eliminated by the subjection of alpha-quartz specimens to mechanical or thermal stresses. The experimental observations can be explained in terms of a reversible phenomenon, namely, the growth of one crystallographic orientation out of another under the influence of stress, for which the new term "piezocrescence" is proposed. An articulated model of atomic arrangement in quartz has been devised to demonstrate, by rotation without breaking the bonds between crystals, the possibility of different orientation.

The idea that the upper atmosphere is "still" because it has been thought to be windless is dispelled by a model contrived by Messrs. B. H. Briggs and G. J. Phillips (Cavendish Laboratory, Cambridge) to illustrate fluctuations of radio echoes returned by reflection from the ionosphere. Supersonic pulses with a 25 kc/s carrier produced in air are reflected from a screen at a distance of 2 m, the echo from the screen being displayed on a cathode-ray oscillograph. An irregular screen which moves steadily causes the strength of the echo to fluctuate. Alternatively, irregular heating of the air near the screen by a small burner causes similar fluctuations, realistically demonstrating the manner in which turbulence in the ionosphere may cause fading of radio signals.

Cold Welding Process

A process of cold welding aluminium and its alloys as well as aluminium to copper depends only on a simple surface treatment followed by sufficient local mechanical pressure to cause appreciable flow of the metal. Examples exhibited by Messrs. R. K. Hilton and A. B. Sowter (G.E.C. research laboratories) concerned "spot" welding, ring-shaped welding for making food containers and continuous welding for forming sheet metal into tubes. The method, as at present developed, is suitable for thicknesses of from one-quarter to three millimetres.

Information about atomic nuclei is largely deduced from the energies of moving particles, which are often represented by the heights of electrical pulses. An analyser of pulse height shown by Messrs. G. W. Hutchinson and G. G. Scarrott (Cavendish Laboratory, Cambridge) can measure pulses at a rate of more than 1,000/sec and record how many have been received within each 60, 80, or 120 equal

voltage (size) ranges. It will sort up to 60 million pulses and display the result continuously on a cathode-ray tube screen as an array of bright and faint dots, denoting the digits one and zero of the binary numbers.

This analyser, designed for use in nuclear physics experiments, differs from others in that it stores the information as a series of binary numbers whose digits are represented by supersonic pulses passing in a regular cycle through a mercury delay line (memory tube) which, together with the use of a common measuring system for all pulse sizes, has made possible great accuracy, moderately high speed, storage capacity, and compactness. Each incoming pulse charges a condenser whose potential is then compared with that of an accurately linear time base synchronized with the delay line cycle. It is recorded by adding one to the binary number next received from the delay line after these two potentials become equal.

To assist the design of hearing aids for the deaf Mr. P. Denes and Dr. D. B. Fry (Phonetics Dept., University College, London) study the effects of certain physical and psychological factors on the efficiencies of speech transmission systems by determining the response up to the point at which "peak-clipping" is applied; efficiency cannot be improved by subsequent frequency correction. Sound recordings are also made of speech under constant physical reception conditions while the efficiency of transmission is varied by linguistic changes.

Automatic apparatus for measuring a minute quantity of chemical (indicator) substance in a biological system is used by Mr. J. L. Mongar and Dr. H. O. Schild (University College, London) for pharmacological assay purposes. They utilize the contraction of a piece of guinea-pig intestine by a solution containing one part of histamine in 100 million. To minimize random variations, the operations of adding the solutions are mechanized. Electrically operated valves (modified telephone relays) compress rubber tubing and so control the flow to and from the jacketed vessel containing the intestinal strip. The cycle of operations is controlled by a telephone uniselector and electronic timer.

What has been described as the world's greatest scientific book, *Philosophiæ Naturalis Principia Mathematica*, by Isaac Newton, original manuscript in the hand of Humphrey Newton, an amanuensis, has recently been restored and rebound by the Public Record Office. It was displayed in the reception room together with the Charter Book of the Royal Society which contains the signatures of Royal patrons and of the Fellows, including those of electrical personalities.

Underground Gasification of Coal

New Site in Worcestershire

THE trial underground gasification of coal conducted by the Ministry of Fuel and Power, which has been in progress at Newman Spinney, near Chesterfield, since 1949, is to be continued at that site for another year. Other trials are being initiated at a site in Worcestershire, near Kidderminster.

At Newman Spinney two new systems will be involved. It is hoped to start gasification at about 80ft depth on one during June. The other and probably larger system will, if possible, be created later by high pressure in the Furnace seam at nearly 200ft depth, using the new technique developed in 1950. These trials aim to discover what changes in gas quality or output, and in the spread of the reaction underground, result from changes in air rate, pressure, use of steam and other factors under manual control.

To find out what effect different coals, or geological formations, may have on the process involves making a succession of tests on a variety of sites representing different conditions, in the selection of which the National Coal Board is actively co-operating.

Exploratory boreholes which are being drilled near the old Bayton Colliery about 9 miles from Kidderminster indicate a faulted geological formation in which the depth of coal varies from 200 to 600ft and on which tests should yield useful information. The intention is to drill some six (6in) boreholes in a circle down to the coal, the holes being cased and grouted, and the coal lying between them ignited and gasified with the aid of air blowers and compressors. This procedure may be repeated several times in the locality on coal at different depths. Each experiment will take several months.

The proposals for the experiments in the Bayton area have been communicated to the County Planning Committee of the Worcestershire County Council and, on the basis of conditions which have been agreed, that body raises no objection.

PERSONAL and SOCIAL

News of Men and Women of the Industry

On his retirement from the position of chief engineer to Evershed & Vignoles, Ltd., **Mr. F. B. Rolfe,** B.Sc.Eng.(Hons.), M.I.E.E., has been appointed a director of the company, with which he has been associated for forty-three years. After leaving King's College, London, Mr. Rolfe was for a time with the British Westinghouse Co. and he joined Eversheds in 1908. He was assistant for a number of years to the managing director, and he has always been closely associated with technical design and manufacture, his earlier work including improvements in the "Megger" insulation tester and the Evershed recorder. In 1922 he developed the Series 2 instrument, and another of Mr. Rolfe's designs, the "Wee Megger" tester, was marketed in 1932, a corresponding range of small ohmmeters being introduced shortly afterwards. More recently he developed a range of special duty f.h.p. motors.

Mr. Rolfe was appointed development manager in 1923 and in 1941 he became chief engineer and was largely responsible for the change-over to wartime production of instruments for the forces. Mr. Rolfe proposes to live near Bournemouth.

We briefly reported last week that **Mr. W. C. Handley,** B.Sc.(Tech.), M.I.E.E., had been appointed an executive director of British Insulated Callender's Cables, Ltd. Mr. Handley's service with B.I.C.C. began in 1923 when he joined the former B.I. Company as technical assistant in the Helsby Cable Test Department. He was transferred in the same year to the Condenser Department and became progressively sales engineer, assistant manager and, in 1941, manager. In 1945 he was appointed director and general manager of the United Insulator Co., Ltd., a B.I.C.C. subsidiary, but retained responsibility for the administration of the Helsby Capacitor Department.

Mr. W. C. Handley

In 1948 Mr. Handley relinquished these departmental duties to become B.I.C.C. liaison officer (subsidiary companies) and he joined the boards of many of the companies of the B.I.C.C. Group. In 1950 he became a member of the company's chief executives' committee. Mr. Handley was educated at Manchester University and during the first world war served with the Royal Engineers in Italy and Egypt.

Mr. G. W. Cartwright, managing director of John T. Cartwright & Sons, Ltd., Glasgow, has been elected president of the Electrical Wholesalers' Federation to fill the vacancy caused by the untimely death of Mr. W. J. Bensley (reported in our last issue). Mr. Cartwright is one of the three sons of the founder of the company and has been active in E.W.F. affairs for some years. He was secretary of the Scottish Section in 1935 and 1936 and chairman of the Section in 1937 and 1950. He has been a general councillor of the Federation since 1948.

Mr. G. W. Cartwright

Mr. Cartwright was apprenticed to the Macfarlane Engineering Co., Ltd., Cathcart, and gained further experience with Garbe & Lahmeyer, Aachen, Germany.

Mr. W. E. Betts, Associate I.E.E., is joining the staff of Switchgear & Equipment, Ltd., as sales manager. Mr. Betts served his apprenticeship with Crompton & Co. and Crompton Parkinson, Ltd., and then specialized in switchgear with that company with whom he has been for twenty-five years.

The Minister of Fuel and Power has appointed **Mr. D. C. Benn** and **Councillor G. H. Green** as members of the South Eastern Electricity Consultative Council in place of Mr. S. B. Till and Councillor H. W. Rymill who have resigned.

Mr. F. D. Felton has been appointed a director of the Revo Electric Co., Ltd.

Mr. R. H. Turtill, A.M.I.E.E., has been appointed general operating superintendent of the Jamaica Public Service Co., Ltd. Before joining the company in 1949 Mr. Turtill held

appointments with Ewbank & Partners, Ltd., the Beds, Cambs & Hunts Electricity Company, and the London Passenger Transport Board.

The Irish Government has appointed two new directors to the Electricity Supply Board. They are **Mr. J. D. Ruch,** of the Irish Sea Fisheries' Association and **Mr. John A. Ryan,** a director of John Power & Son, Ltd.

Mr. R. Clements, B.Sc., for the past three years press and public relations officer for Chloride Batteries, Ltd., is giving up this position at the end of the month to devote himself to his farm in Hertfordshire. Mr. Clements will also be working on a new edition of Tilden's "Chemical Discovery and Invention in the Twentieth Century."

Mr. H. Marshall, B.Sc., has been appointed deputy technical manager of Scottish Cables, Ltd., Renfrew. Mr. Marshall, who received his technical education at King's College, Newcastle - on - Tyne, and his practical training with C. A. Parsons & Co., Ltd., and A. Reyrolle & Co., Ltd., has held positions with the Ministry of Supply and Merz & McLellan, Newcastle, from whose staff he resigned on taking up his present position.

Mr. H. Marshall

Mr. L. V. Turner, M.I.E.E., has retired from the post of Taunton Sub-Area manager, South Western Electricity Board, after forty years with the electricity supply industry. After serving an apprenticeship with Newton's, Ltd. (later Rotax, Ltd.), Mr. Turner became a trainee in the Croydon Electricity Department and, following four years as a power station engineer, took up an appointment with Vickers, Ltd. In 1919 he went to the Taunton Electricity Department as meter superintendent; he became mains superintendent in 1925, deputy borough electrical engineer and manager in 1931, and borough electrical engineer and manager in 1936. Upon nationalization Mr. Turner was appointed Sub-Area manager, Taunton.

As we have already reported, Mr. Turner will be succeeded by **Mr. E. A. Newburn,** M.I.E.E.

To celebrate the 150th year of the business, **Mather & Platt, Ltd.,** arranged for about 4,000 employees to visit the South Bank Festival Exhibition last Saturday. Seven special trains were chartered and a very full programme was organized, including evening visits to theatres.

On Thursday and Friday last week the **Portland Players** (B.E.A. Sports & Social Club) gave performances of "Little Lambs Eat Ivy," a three-act comedy by Noel Langley, at the Portland Hall, London, W.1. This, their fourth play, gave the whole cast an excellent opportunity of showing how they have developed since their first appearance. The play revolves about Essie, Lady Buckering, the widowed mother of a family of varied temperaments; this arduous part was very ably undertaken by Gloria Henshaw. She was admirably supported by Jean Ward, Eileen Wardle and Margaret Stratton as her daughters, T. Hedley Mason as Dr. Drew, Antony Hemming (Dougall Pitchford), Ken Wheeler (Clifford Magill), Michael Marcus (Wilfred Marks), Renée Futcher (Nurse Pynegar), Anthony Moss (Roland Wayne) and Ken Wood (Corder, the manservant). Lord Citrine (chairman of the B.E.A.), Lady Citrine, Mr. H. F. Carpenter (secretary, B.E.A.) and Mrs. Carpenter were among the audience at the Friday performance. After the final curtain Lord Citrine thanked and congratulated the players and spoke highly of the work of the producer, Mrs. E. Manning.

Col. Robert McCreary, M.C., O.B.E., general manager and engineer of the Belfast Transport Department, informs us that while he was in France in 1940 he was not in the retreat to Dunkirk, as stated in our last issue. At the time of Dunkirk his headquarters were in Rouen where he remained until 10th June, 1940, leaving Rouen the night before it was occupied by the Germans. For the following week he was engaged on work in the area just west of the Seine and eventually left France from La Rochelle on a Cardiff coal boat, arriving in England on 22nd June, 1940.

An interesting ceremony took place at Trafford Park on 22nd May, when Mr. I. R. Cox, D.S.O., managing director of the **Metropolitan-Vickers Electrical Co., Ltd.,** presented gifts from the company to 165 employees who, during 1950, had completed thirty-five years' service. It was the fourteenth of these annual presentations and the company has now a total of 1,400 employees of thirty-five years' standing and over. This year's recipients, among whom were nine women, had the choice of a Westminster chimes clock, a e.p.n.s. tea service, a canteen of cutlery or National Savings Certificates. Mr. H. Annis, chairman of the Long Service Association, presided.

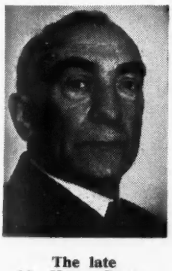
OBITUARY

Mr. N. S. Sim, B.Sc.(Eng.), A.R.T.C.—The death occurred on 12th May at the age of sixty-five of Mr. Norman Stuart Sim, of the English Electric Co., Ltd., Stafford. Mr. Sim was educated at Robert Gordon's College,

Aberdeen, and the Royal Technical College, Glasgow, graduating at Glasgow University. He served his apprenticeship with Hall, Russell & Co., Ltd., and the British Electric Plant Co., Ltd., followed by nine months in the switchgear drawing office of Mavor & Coulson. In 1911 Mr. Sim joined the A.C. Design Department of Siemens Bros. Dynamo Works, Ltd., at Stafford. He was awarded the M.C. at Arras in 1917 and was discharged from the army in 1919 as a result of wounds he received, with the rank of captain. He returned to the A.C. Design Department of Siemens Works, Stafford, until September, 1921, and served in the Central Design Department, London, of the English Electric Co., from 1921 to 1925, when the design department was transferred to the company's Stafford Works. From that date to the time of his death he remained in the A.C. Section of the Machine Design Department, Stafford.

Mr. H. Brooke, who until his retirement five years ago was chief of the Technical Engineering Department of Allen West & Co., Ltd., Brighton, died recently at the age of sixty-six. Mr. Brooke joined Allen West & Co. on its formation in 1910, having previously served with the Millwall Electrical Co., from which Allen West & Co. grew. The funeral took place on 25th May.

Mr. Henry Coates, J.P., M.I.E.E., a director of the Watford Electric & Manufacturing Co., Ltd., and member of the Electricity Consultative Council for the Eastern Area, died on 24th May on his sixty-fifth birthday after a long illness. He served as chairman of the Watford Electric Lighting and Power Committee for over twenty years, was an alderman of Watford for many years and was twice elected Mayor.



The late Mr. Henry Coates

Mr. H. Baird.—The death occurred on 27th May of Mr. Harold Baird, Manchester district manager, Sloan Electrical Co., Ltd. He was sixty-three years of age. Mr. Baird joined the company in 1907 and for thirty-one years was chief representative in Lancashire and Cheshire and was appointed district manager in 1938.

Mr. F. P. G. Telfer.—The death occurred on 27th May, at the age of fifty-three, of Mr. Frank Phillips Goodman Telfer, M.C., M.I.E.E., principal production officer, Instrument and Radio Production Branch, Aircraft Supplies, Ministry of Supply. Before joining the Ministry in 1942 as deputy assistant director (chief valve officer), Mr. Telfer was for eighteen years with the M.O. Valve Co., Ltd.

Mr. F. W. Maynard, mining representative for A. Reyrolle & Co., Ltd., in the Midland Divisions, died on 23rd May. He had devoted most of his life to mining, electrical and mechanical engineering problems and before joining A. Reyrolle & Co. had been chief engineer to colliery companies both in the Midlands and on the North-East Coast.

Mr. H. J. Hadrill.—The death occurred suddenly at Wallasey on 27th May of Mr. H. J. Hadrill, A.M.I.E.E., aged fifty-seven, who since vesting day had been district engineer of the Wallasey District, No. 3 Sub-Area, Merseyside and North Wales Electricity Board. Mr. Hadrill joined the former Wallasey Corporation electricity undertaking in 1919.

Lady Gill.—The death is announced of Caroline Maude, Lady Gill, at Shortlands, Kent, on 23rd May. Lady Gill was the widow of Sir Frank Gill who died in October last.

Lady Thomson.—The death occurred last week of Rose Elizabeth, Lady Thomson, widow of Sir Joseph J. Thomson, O.M., Master of Trinity College, Cambridge, the celebrated physicist.

WILLS

Lt.-Col. Sir John Henry Maitland Greenly, K.C.M.G., C.B.E., late chairman of Babcock & Wilcox, Ltd., and British Non-Ferrous Metals Research Association, and a director of the Power Securities Corporation, Ltd., left £57,819 gross (£52,985 net).

Mr. P. Ormiston, A.M.I.E.E., chief generation engineer (operations), East Midlands Division, B.E.A., and former chief engineer of the Midland Counties Electric Supply Co., who died on 16th December last, left £12,243 gross (£11,417 net).

Mr. A. W. Lay, B.Sc., A.M.I.E.E., who was with Marconi's Wireless Telegraph Co., Ltd., and was well-known for his work in the fields of diathermy and electronic instrumentation, and who died on 3rd February last, left £5.794 gross (£3,422 net).

Major G. C. Milnes, M.C., M.I.E.E., former city electrical engineer of Lancaster, who died on 2nd January, left £7,815 gross (£7,689 net).

Mr. R. B. Mitchell, M.I.E.E., formerly general manager of the Glasgow Corporation Electricity Department, left personal estate in England and Scotland valued at £12,764.

Mr. G. F. Mansbridge, O.B.E., M.I.E.E., for many years connected with the Dubilier Condenser Co. (1925), Ltd., left £38,760 gross (£37,290 net).

NEW BOOKS

The Nationalized Industries: An Analysis of the Statutory Provisions. By D. N. Chester, C.B.E. (Fellow of Nuffield College, Oxford). 93 pp. George Allen & Unwin, Ltd., Ruskin House, 40, Museum Street, London, W.C.1. Price 7s 6d.

This is the second edition of a study published in 1946 undertaken for the Institute of Public Administration. Thus it deals for the first time with the services nationalized by the present Government but it also still covers the now-defunct Central Electricity Board and London Passenger Transport Board.

Mr. Chester employs a comparative method in his analysis of the constitution and functions of the various corporations, pointing out significant differences in some cases. The work forms a compact guide to the nature of the public boards and is rounded off with a useful bibliography.—J.H.C.

Mathematics of Circuit Analysis. By E. A. Guillemin. Pp. 590; figs. and index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 60s in U.K.

The vigorous development of engineering science during the first half of this century and particularly during the last two decades is closely linked with an increasing penetration of mathematics. This penetration has a twofold character; partly there is a more intense application of known methods to the solution of problems which on account of their real or apparent complexity had not been tackled before, and partly there is an application of new concepts and methods. It is this which occasionally creates difficulties for the engineer who wishes to keep abreast of current developments.

Post-graduate lectures are one means for coping with this situation, but they can reach only a limited public. Others have to be content with text-books which until recently were mostly written from the point of view of the mathematician.

This new book by Professor Guillemin fulfils at least part of this need for text-books on the mathematics of engineering and within the broad range that it covers it fulfils it admirably. It is a pity, however, that the author has chosen a rather restrictive title. The material covered is really all fundamental engineering mathematics as will be seen from the following chapter headings: determinants, matrices, linear transformations, quadratic forms, vector analysis, functions of a complex variable, Fourier series and integrals.

All these topics are treated on a purely mathematical basis and without reference to specific circuit concepts. Physical interpretations never enter into the argument, and although the author disclaims mathematical rigour he has gone very much further in the discussion of delicate points than one finds usually in a book of this kind. Nevertheless, he has maintained an easily readable style throughout.—A.B.

Books Received

Short Wave Wireless Communication. Fifth edition. By C. R. Stoner. Pp. 717; figs. 417; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 50s.

Principles of Electrical Engineering Theory and Practice. Third edition. By Grover C. Blalock. Pp. 605; figs. 433; index. McGraw-Hill Co., Ltd., Aldwych House, Aldwych, London, W.C.2. Price 47s in U.K.

La Technique du Vide. By Maurice Leblanc. Pp. 187; figs. 49; index. Libraire Armand Colin, 103, Boulevard Saint-Michel, Paris. Price 200fr.

Industrial Lighting

A HANDBOOK (No. 7 in its Electrical Illumination series) on "Industrial Lighting" has been published by the Lighting Service Bureau. This has not been reprinted since before the war when it was called "Factory and Workshop Lighting," and all the material in this present publication is new. It indicates the factors which should be considered in the lighting of industrial premises. The dependence of production on correct lighting is discussed, and the value of bright, cheerful surroundings in stimulating workers is also emphasized. Cost is dealt with in relation to output, spoilage, labour turnover and other factors of concern to the factory management. The booklet is profusely illustrated with examples of modern lighting installations. Copies are available from the London or Provincial Bureaux free of charge.

Contractors at Harrogate

Jubilee Conference

The Royal Hall, Harrogate, with the Hotel Majestic in the background

As 1951 marks the golden jubilee of the Electrical Contractors' Association it was fitting that this week's conference at Harrogate should have attracted a record number of people—nearly 800 in all. Harrogate is at its best in May and its masses of bright flowers made up for the rather dull weather with which the function began. A nice touch at this conference was the presentation to each lady visitor of a spray of flowers to mark the occasion of the jubilee.

There was a good muster for the Council meeting on Monday, but some of the E.C.A. veterans were greatly missed, particularly Mr. W. R. Rawlings, the first president, and Mr. W. H. Walton, another past-president. We were pleased, however, to see Mr. T. E. Alger, also a past-president, who can claim to be the Association's second oldest member.

Delegates to the conference from all the many branches of the Association flooded in on Monday and kept the registration office at the Hotel Majestic extremely busy. At the same hotel in the evening Mr. P. G. Wallis, Associate I.E.E., the President, and Mrs. Wallis, held the customary reception which was followed by a conversazione and dance. Among the guests were Lord and Lady Citrine, Mr. E. Buttner of the Association's American counterpart, who was accompanied by Mrs. Buttner, Dame Caroline Haslett and Mr. E. R. Wilkinson. Music was provided by Conri Tait's Dance Orchestra and there was an entertainment by the Harrogate Irish Dancers.

Tuesday's programme was a very crowded one. It started in the morning with a civic welcome at the Royal Hall by the Mayor of Harrogate (Councillor J. S. Holmes, J.P.) who was thanked by the President. Next Mr. Wallis read his

The Council of the Electrical Contractors' Association

Mr. J. C. Verdie and Mrs. S. M. Barlow

presidential address which is summarized on page 1147. Then followed the first of the three conference papers, "Storage Battery Emergency Lighting Systems" by Mr. E. R. Sanderson.

Six speakers took part in the discussion. The questions raised and answered by Mr. Sanderson related to automatic charging systems, the use of normal voltage and low voltage lamps in shadowless lighting systems in operating theatre lighting and the type of charger. With regard to the last, Mr. Sanderson said that for the larger batteries the mercury vapour rectifier was best, but there were advantages in the metal rectifier for smaller batteries. He thought that usually there would be little difficulty in the ventilation of battery rooms, particularly with sealed cells.

Mr. Sanderson assured the contractors that he was not reflecting upon their ability when he suggested that battery makers should be called upon to erect open-top batteries; it was a question of every man to his trade. Periodical discharge of batteries did no harm as a check, although this was not necessary with trickle charging. Cheap self-contained battery outfits were very useful on occasions. A B.S.I. committee appointed to suggest standards for emergency lighting had found that there were too many variables. Rectifiers were as good as d.c. generators for charging, but heating in half wave rectifiers had to be watched. In some cases there was a danger from the presence of 100 c/s ripple current.

After the luncheon interval Mr. W. T. Trace (vice-president) presented his paper on "The National Apprenticeship Scheme" which drew comments from a number of speakers. Most of them agreed that the apprenticeship scheme was the best that could be contrived in present circumstances. But several of them questioned its adequacy and made suggestions for its improvement. The figure of 4 per cent "wastage" of electricians was queried and further investigation of the governing factors was considered necessary. One point raised was the position of older youths who remained at school until the age of 17; these were considered desirable recruits for whom provision should be made. Mr. E. Buttner (U.S.A.) took part in the discussion, remarking particularly upon the great difference which existed between the British and American apprenticeship systems.

"Conversation piece" at the Hotel Majestic

1. Mr. E. Simpson and Mr. J. R. Halliwell. 2. Messrs. T. A. Garness and A. S. Redvers Pratt. 3. Messrs. T. E. Alger, N. Aish and S. N. Watkins. 4. Messrs. R. H. Marryat and R. L. Lowe. 5. The President with Messrs. L. C. Penwill, M. R. H. Sadler, T. E. Alger and J. G. Briggs. 6. Messrs. V. J. Stock and C. J. Veness. 7. Mr. R. J. Chatham, Mrs. A. V. Milton and Mr. L. W. Bryan. 8. Messrs. G. Jessop, M. E. Broadbent and T. C. Gray. 9. Messrs. T. Jones, J. W. Johnson, S. M. Barlow, W. J. B. Soper and S. Dickinson. 10. Messrs. J. Newth, F. J. R. Makin, G. H. Williams and H. Harding. 11. Mr. C. R. Bates, Mrs. Bates, Mrs. Brammer, Mr. A. Brammer and Mrs. N. Aish. 12. Mr. A. H. Goude, Mrs. Goude, Mr. W. C. Huston and Mr. V. P. Jackson

AT THE PRESIDENT'S RECEPTION

1. Lord and Lady Citrine and Mr. Penwill. 2. Mr. and Mrs. R. E. Bristow and party. 3. Mr. and Mrs. H. E. Brand and Mr. and Mrs. H. A. Partridge. 4. Mr. and Mrs. E. A. Reynolds. 5. Mr. and Mrs. M. R. Neville. 6. Miss E. F. Crawford, Mr. J. Crawford, Mr. and Mrs. A. O. Bruty and Mr. G. A. Wilson. 7. The President receiving Mr. and Mrs. E. Buttner (U.S.A.)

The third paper by Mr. L. C. Penwill, Companion I.E.E., director and secretary of the E.C.A., was more controversial and extended reference to the discussion will be made in next week's issue.

Following precedent the evening was devoted to a reception at the Royal Hall by the Mayor and Mayoress and a subsequent dance.

On Wednesday morning the delegates again assembled at the Royal Hall for the annual general meeting when the opportunity was taken to make a presentation from the members to Mr. L. C. Penwill in recognition of his services to the Association for a quarter of a century. After a break for coffee the installation of the new President, Mr. Stanley N. Watkins, took place. Mr. Watkins gave a brief address and a few remarks by Lord Citrine were much appreciated by the delegates. The meeting concluded with votes of thanks to the Mayor and Corporation of Harrogate, the stewards and others who had helped to make the conference a success.

A garden party in the beautiful Valley Gardens was arranged for the afternoon with a programme of music by the band of the 5th Battalion of the West Yorkshire Regiment. At the Royal Hall in the evening there was a smoking concert followed by dancing.

Presidential Address

IN the course of his address on Tuesday the President (Mr. P. G. Wallis, Associate I.E.E.) said that the Association's golden jubilee coincided with the silver jubilee of the first conference. At that conference the then President, Mr. T. E. Alger, spoke of the Association's aims and accomplishments and, ten years later, Mr. A. G. Bruty mentioned the illimitable applications of electricity.

To-day the position of electricity supply was doubtful and we were compelled to ask ourselves whether the best use had been made of the six years which had elapsed since the war ended. Mr. Wallis said that "honest-to-goodness" economics had given place to a political economy of a somewhat peculiar brand. We were called upon to rearm and at the same time extend the social services; the problem could be solved only by increased production. Could the country afford the luxury of a 40- or 44-hour week? Could we afford the loss of production which resulted from strikes? Could we afford extravagant colonial experiments? He suggested that too many people were engaged in unproductive or restrictive activities in the employment of the State.

Reviewing the E.C.A.'s work during the past year, Mr. Wallis reported steady progress. The Association had told the Minister of Labour that it did not consider a payment-by-results scheme practicable. The phenomenal rise in the cost of living had resulted in a substantial wage increase in the industry but the full effect of the present inflationary policy had not yet been felt.

In a reference to the apprenticeship scheme—the first of its kind in the electrical contracting industry—the President said that the scheme should be given a fair trial and an opportunity to operate so that any necessary adjustments could be made in the light of experience. Another development was the establishment of Area Joint Industrial Councils. Here too experience might show that adjustments would have to be made.

The contracting industry had its share of people who gloried in creating industrial unrest but he hoped that the Electrical Trades Union would have an increasing sense of its responsibilities and take effective action against those of its members who caused trouble. The N.F.E.A. and E.T.U. had mutual responsibilities for ensuring adequate electrical service to the public at economic rates. The policy of the National Joint Industrial Council should be to establish *what* was right not *who* was right.

The Association's scheme for guaranteeing members' work had been extended by the Association's acceptance, when required, of financial responsibility for the performance by members of contracts with local authorities and others.

After referring to the Fair Trading Council, Mr. Wallis spoke of negotiations between N.E.C.T.A., Ltd., and other sections of the electrical industry. He regretted that progress with the Cable Makers' Association had been less effective than they had hoped but said that negotiations had now been re-opened and he hoped for beneficial results.

The President set out the aims of the Association in the field of electrical trading, which were that the trade discount should be an equitable assessment of the service rendered by the electrical contractor and retailer in distributing manufacturers' products and that an equitable schedule of quantity discounts should be established and correctly applied. Slow progress had been made in the latter connection and he suggested that the industry was failing to grasp the present opportunity of setting up a stabilized trading structure which would stand the test of critical examination by Government Departments and others. As regarded purchase tax, Mr. Wallis said that the industry seemed to have been singled out for attack without any justification.

He understood that the work of the Organizing Committee dealing with the National Inspection Council was practically complete. It would lead to the establishment of a voluntary register of electrical

installation contractors on a more extensive scale than ever before. It might be argued that this would delay the fulfilment of the Association's objective of compulsory registration, but equally it might be a direct approach to compulsory registration in the not-too-distant future. It was a strange coincidence that the Ministry of Works had established a committee to examine the possibility of a scheme of compulsory registration.

In their relationship with the British Electricity Authority there had been an excellent spirit of co-operation at Area Board level for which he thanked Lord Citrine and the Board chairmen. The Association was still concerned, however, with the unfair competition in hire-purchase trading; it was not satisfied that the Board's accounts reflected the true commercial considerations. The Association wished to see a reopening of the negotiations foreseen when the "Summary of Agreed Principles" was drawn up.

Mr. Wallis said that competent electrical installation work and adequate and experienced maintenance were more vital than ever before and he urged the public for their own benefit and safety to see that their electrical requirements were met by those who were properly qualified.

Referring to the work of the Electrical Industries Benevolent Association the President said that to commemorate the E.C.A.'s golden jubilee it had been decided to erect a chalet at the E.I.B.A. Broome Park estate in the name of the members.

During the past year the membership of the Association had reached 3,000. He regretted that there had been some cancellations through unwillingness to conform to certain of the industrial agreements existing between the N.F.E.A. and the E.T.U.

Mr. Wallis paid a tribute to the work of Mr. Penwill, the director and secretary, and every member of his staff.

Emergency Lighting Systems

IN his paper on "Storage Battery Emergency Lighting Systems," Mr. E. R. Sanderson, A.M.Inst.C.E., A.M.I.E.E. (Chloride Batteries, Ltd.) dealt with various arrangements and applications of his company's system. His introduction surveyed the scope for such plant in public buildings and other large establishments and discussed battery characteristics. Dealing with charging methods he said that experience had proved that stationary batteries with Planté positive plates could have a life of twenty years or more when given simple care under the trickle charge system.

The floating system could be used only where safety or secondary lighting had to be used regularly as a partial means of normal illumination. Describing that system, the author said that it was now specifically approved in the new Cinema Regulations. Metal or valve rectifiers or motor-generators were used and the methods of controlling their output were described.

One type of automatic floating rectifier employed control chokes whose saturation varied with changes in the d.c. load. Other types employed static control through the design and connection of transformers, metal rectifiers, chokes and condensers. The advantage of the floating system was that it did not require the successful operation of an automatic switch on the failure of the normal supply, but its overall efficiency was lower and it needed more attention than the trickle charge system.

Mr. Sanderson then dealt with his company's trickle charge and automatic switch system comprising the storage battery, a rectifier for giving a continuous trickle charge and an occasional quick re-charge and an automatic switch or contactor. With diagrams he illustrated and described the "maintained" and "non-maintained" variants of the method, i.e., changing over the mains-supplied secondary lighting circuit to the battery or changing over the battery from trickle-charge to emergency lighting upon the failure of the normal supply. A typical non-maintained system for a hospital was explained and brief reference was made to a maintained system for hospitals. Means for ensuring the maintenance of operating table lighting were mentioned.

Next equipment suitable for the safety lighting of cinemas was dealt with, the

author explaining that this was normally supplied from the main a.c. supply through a transformer stepping down to 100 or 50 V to suit the associated battery. In some large cinemas 230 V safety lighting was used and it might then be desirable to install an isolating 230/230 V transformer between the main a.c. system and the change-over contactor to avoid the possibility of 400 V between normal and secondary lighting. Also it was undesirable to earth the battery. Other points to be observed were mentioned.

Similar systems were used in other large buildings and in some cases the load was large enough to warrant balancing on the three phases. The author described the switching arrangements for such cases. To avoid the use of a motor-generator it was usual with systems for use on d.c. mains to employ a battery of the same nominal voltage.

The next section of the paper was devoted to the layout of battery rooms and the erection of the batteries. Mr. Sanderson considered that the erection of open top cells, which required much skill, should be done by the battery makers.

With regard to maintenance, the author said that stationary type cells with heavy Planté positive plates and box type negatives gave very little trouble, but the makers' instructions should be followed carefully.

The new Cinematograph Regulations were quoted in so far as they related to batteries and associated equipment and in the concluding paragraphs of the paper reference was made to B.S. 764 covering change-over contactors and emergency lighting in power stations and substations.

National Apprenticeship Scheme

THIS paper, by Mr. W. T. Trace (vice-president of the E.C.A.), was prefaced by a brief study of the history of craft apprenticeship and the need for additional education brought about by technical progress—a need which was very pronounced in electrical installation work.

It was shown that from the earliest days the Electrical Contractors' Association had been concerned with training and had encouraged members to make proper arrangements for apprentices. Reference was made to the form of indenture drawn up by the Liverpool branch and widely adopted elsewhere. In 1928 the Association and the City and Guilds of London Institute formed an Advisory Committee on Electrical Installation Work on which teaching interests were represented. This Committee's work resulted in new syllabuses and a certificate scheme in which connection medals, certificates and monetary awards were given by the Association.

Before September, 1950, arrangements for indenturing apprentices were left entirely to the employers and parents, although suitable forms were supplied by the Association. An agreement reached in 1943 recognized three classes of youths:—Category I, indentured apprentices; Category II, youths engaged on a verbal understanding that if they were industrious and well-behaved they would be treated as normal apprentices; and Category III, youths engaged without any undertaking in respect of training or retention. It was accepted that the conditions and wages of indentured apprentices were the sole concern of the parties to the deed; a scheme of registration and a joint agreement on wages were introduced for unindentured apprentices; and the employment of Category III boys was discouraged by stipulating that they should be paid a higher rate than Category II boys. At the end of August, 1950, 4,451 Category II boys had been registered.

The practical training of Category I and Category II boys had varied according to the size of the firm, the type of its work and the number of apprentices engaged. There had been even greater differences in their technical training, a first essential in this highly complex and scientific age.

Negotiations after the introduction of the 1944 Education Act led to the appointment by the National Joint Industrial Council for the Electrical Contracting Industry of a joint apprenticeship committee to formulate conditions of apprenticeship. This committee studied the first report of the Ministry of Works' Building Apprenticeship and Training Council. The N.F.E.A. was provisionally a member of this Council but

subsequently decided to withdraw. The Apprenticeship Committee continued to discuss a deed of apprenticeship and scheme of apprenticeship but a conflict of views between the N.F.E.A. and E.T.U. on the principal object of such a scheme became apparent. However, after almost six years of negotiation a scheme was ratified, although (the author says) it could at the best be regarded as a compromise between the conflicting views of the parties.

The first meeting of the Apprenticeship and Training Council for the Electrical Contracting Industry was held in July, 1948. The Council comprised representatives of the N.F.E.A., the E.T.U. and the Ministries of Education, Health, Labour and Works.

Details of the scheme were set out in the paper. It provided for a probationary period of three months. The employer decided whether the apprentice was to be indentured or not whereupon the apprentice was registered; a registration fee of 10s was credited to a Further Education Fund from which grants might be made at the Council's discretion. Rates of wages and conditions of payment were laid down and there was a holiday clause.

Another clause provided that up to the age of 18 apprentices must attend technical courses, where they were available, and the conditions of attendance were laid down. On completion of the apprenticeship an appropriate certificate and card were issued to the apprentice. Mr. Trace mentioned that after 1951 no new Category III boys could be engaged which might mean in some cases the employment of more apprentices or adult mates.

Mentioning the E.T.U.'s desire to alter the permitted proportion of apprentices to journeymen (now one to five) the author gave calculations to show that an assumed annual " wastage " of 4 per cent must be made up during five cycles of apprenticeship but he asked whether there were enough journeymen electricians in the industry at the moment or for future requirements. The Association had successfully argued before the National Arbitration Tribunal that it would be unwise to limit further the recruitment of apprentices.

It was desirable, in spite of the calls on his time, for the employer to try to understand the causes underlying the indifferent attitude of the modern youth and to ensure the success of the scheme the full co-operation of the E.T.U. and the journeyman electrician was necessary. Contractors had been accused of employing so-called apprentices as a form of cheap labour and paying little attention to their training. They should make every endeavour to comply with the scheme so as to disarm any future criticism. The National Apprenticeship Scheme provided the means of giving a more or less uniform training which could not fail to contribute to the country's industrial well-being.

Trading Structure of the Industry

MR. L. C. PENWILL (director and secretary of the E.C.A.) opened his paper on " Some Aspects of the Trading Structure of the Electrical Industry " by making it clear that the views expressed were not necessarily those of N.E.C.T.A., Ltd.; indeed, he said, the opposite was sometimes the case.

One of the two main reasons for the Association's establishment was to secure fair trading conditions. When the original Committee " D " was set up in 1927, followed by the Fair Trading Council, it was evident that custom and practice had become so firmly established that it was impossible to eradicate a large number of existing evils. The Fair Trading Policy and stated principles did not constitute the Utopia of fair trading; they only represented the greatest common measure of agreement it was found possible to secure among all trading sections of the industry.

The aim of the Fair Trading Council was to secure fair rewards for work done and thus ensure equity and fair dealing, good service to the public and advancement of the cause of electricity.

N.E.C.T.A., Ltd., had advocated the limiting of discounts to reasonable proportions to ensure fair prices to the public but there was a doubt now whether its advocacy had been justified. Contractors' and retailers' costs were continuing to rise and trade discounts were not being confined to

the trade. There were large industrialists who would command special concessions but they were few. The N.E.C.T.A. supported the principle of quantity discounts so long as they were based on the saving effected by the manufacturer or wholesaler by selling in large rather than small quantities. But trade terms were given to organizations which performed no service in the electrical industry. They were entitled to quantity recognition only to the commercially sound extent indicated.

The present margin allowed to contractors and retailers was too low when compared with the discounts given to special large buyers or recognized users. Manufacturers would either have to face an increase in the present trade discount or ensure that this discount was reserved to those entitled to it. The so-called "recognized user" should cease to exist and the special large buyer should be given recognition because of his large quantity purchases. Mr. Penwill resuscitated the idea of "standard packages" with a certain discount for a sale of an unbroken package and reduced discounts for smaller quantities. This, he thought, would be a fair way of granting quantity discounts.

As a result of the shorter working week a surprisingly large number of electricians were doing work in their spare time. Was it not possible for wholesalers and manufacturers to refuse to supply material except to genuine trade buyers? To do otherwise was a breach of the Fair Trading Policy.

While the electrical wholesaler performed a useful purpose as a link between the manufacturer and the contractor and retailer, he must determine whether he existed to supply the trade or whether he was to continue to supply the actual user. It was agreed that the wholesaler could claim the same freedom of action as the manufacturer with the customers he served, but how long would the position be allowed to continue by which the contractor's source of supply was at the same time his competitor?

The Fair Trading Policy was vague on this subject, it being recognized that only the manufacturer could determine the value of the wholesaler's service. Some manufacturers used the wholesaler; others declined to do so. Between the two extremes there was a large variation in practice. Mr. Penwill said he would favour a substantial reduction in the wholesaler's "preferential" and the institution of a schedule of quantity discounts which should be applied equally to the contractor or retailer who qualified for them. He thought that this would settle the vexed problem of discounts to the B.E.A. and Area Boards. Wholesalers who were sole distributors for manufacturers should be rewarded accordingly.

Although on current-consuming devices the present margin was inadequate some consideration might be given to the reduction of discount on installation material if, as a *quid pro quo*, the recognized user and special large buyer classes were eliminated.

Overheads and Profits

Discussing the present methods of charging overheads and profits, Mr. Penwill wondered whether they should not be revised. Instead of adding a certain percentage to the cost of labour and materials the contractor might cover himself by charging a higher percentage on the labour content of the job. This might make the customer who bought his own material realize that this was false economy.

The electrical retailer's problem was different in that he had no opportunity of using the labour content of a transaction in the way suggested. He did not believe, personally, that in the long run an increased trade discount would be advantageous but there were strong arguments in favour of it, unless manufacturers were prepared to reserve trade discount exclusively to the trade. The argument against increased discount was that it might encourage price-cutting by people who did not give adequate technical service. Mr. Penwill returned to the theme of granting discounts to unauthorized persons but excluded from this class large departmental stores with electrical departments and the Electricity Boards.

He believed that the time had come for a reasonable restriction of the retail channels for electrical merchandise. There were a number of "perfectly legitimate" ironmongers, cycle dealers and others who, without any pretence of being technically qualified, were engaged in retailing certain current-consuming devices. He had no wish to advocate unreasonable restrictive practice, but he held the view that effective service was possible only through channels where adequate facilities existed and technical appreciation and guidance was available to the public.

Instrument Design

Three-Day Conference at I.E.E.

ELECTRICAL instruments are now used to an ever-increasing extent in almost all industries and it is often the case that the availability of suitable measuring devices governs the technical advances which can be made in any given sphere of activity, particularly research. In view of this, great importance is attached to a conference on electrical instrument design which has just been held at the Institution of Electrical Engineers in London (28th–30th May).

The conference comprised an opening meeting and four technical sessions during which ten papers were presented on a wide range of topics related to instrument design. The opening address was delivered on Monday evening by Dr. W. G. Radley (G.P.O.) and after this Dr. L. Hartshorn (N.P.L.) gave a lecture entitled " Some Aspects of Electrical Instrument Design."

Trends in Design

At the first technical session, on Tuesday, trends in modern instrument design and construction were dealt with. Mr. D. C. Gall (H. Tinsley & Co., Ltd.) opened the proceedings by presenting a paper which comprised a commentary on the new principles in electrical measurements, " new principles " being defined as first applications of the laws of physics. The author briefly reviewed some of the principles which have come into use during recent years, such as those involved in the amplification of small direct currents, and dealt with those developments which have resulted in a progressive sensitivity in measurement. He also spoke on power measurement by calorimetry, the use of ultrasonics in mechanical problems and the applications of pulse techniques. The background upon which each of these methods has been developed was recalled and commented upon and in conclusion the economic reasons for, and the implications in the use of, new principles, and the methods involved thereby, were reviewed.

The next paper, presented by Mr. L. B. S. Golds (Eastern Electricity Board) comprised a survey of modern methods of presentation of instrument readings and recordings. After discussing the relation of the display of the reading to the design of the instrument as a whole, the author described some of the characteristics of the human eye and brain which affect seeing power. He then dealt in detail with the various factors affecting the presentation of the instrument reading which have to be considered by the designer and referred to subjective tests carried out at Cambridge University and elsewhere.

A brief display specification for laboratory and industrial instruments was then given and commented upon, followed by a description of developments in presentation technique. Possible developments with a view to improving the readability of instruments were outlined and in conclusion the author said that it should always be kept in mind by the designer that the purpose of instrument reading presentation was to communicate the value of the measurement rapidly and accurately to the observer's intelligence with the least effort on his part. The design of the movement of the instrument was mainly technical, but the design of the presentation of the reading must meet both technical and æsthetic requirements.

Limits of Measurement

When the second technical session, on the limits of measurement, present and future, was held in the evening Mr. A. Felton (N.P.L.) dealt with the accuracy of measurement of electrical standards and explained the difference between " international " and " absolute " electrical units, giving the reason for the change made in 1948 from one system to the other. He said that the uncertainty of the electrical units defined in terms of length, mass and time was estimated to be about 20 parts in a million, although the accuracy of comparison of electrical quantities might be as high as one part in ten million. The loss

of accuracy in the measurement of voltage, current and power when transferring from d.c. to a.c. was also explained, it being estimated that these quantities could not be measured at power frequencies to better than one part in 10,000.

The performance limits of the best types of electrical instrument were then considered by Dr. A. H. M. Arnold (N.P.L.). He said that the errors from unknown causes had, in general, been reduced to negligible values in specially adjusted instruments and, in this sense, the design of electrical instruments had achieved finality. However, there was still room for improvement in the reduction of errors from known causes and in raising the level of the commercial product, as distinct from the specially adjusted laboratory one.

The defects in instruments submitted for test by the N.P.L. were described in detail; some of the most important of these were scale errors, level errors and sticking of the movement. There were many other defects which could be eliminated by more careful inspection during manufacture.

Instrument design might be improved with a view to reducing errors from known causes. One which was becoming increasingly important was the frequency error; this was usually small in the best instruments at power frequencies but might become so large at moderately high audio frequencies as to render the instrument useless. The frequency errors of a number of instruments were considered, and the improvements made possible by simple types of compensation demonstrated.

Materials and Components

On Wednesday afternoon Dr. G. A. V. Sowter (Telegraph Construction & Maintenance Co., Ltd.) opened the technical session on materials and components by outlining the merits of a number of high-permeability magnetic alloys under a variety of conditions likely to be met in instrument practice. He indicated the properties found with d.c., a.c. and combined a.c./d.c. operation, and made recommendations for the best alloy to be employed in particular circumstances. The paper also included curves likely to be of reference value to designers.

Mr. C. G. Garton (E.R.A.) then read a paper which comprised a general discussion of the properties of insulating materials used in electrical instruments, with emphasis on the new synthetic organic materials. Values of dielectric constant and loss angle were quoted and the structures of the main polymers of electrical interest and the relations between structure and electrical properties briefly indicated. The advantages in instrument design of using small amounts of high-quality insulating materials, rather than larger amounts of the older conventional materials, were discussed with reference to the properties of the newer synthetic materials, the electrical behaviour of the latter being considered chiefly with reference to moisture absorption and electric strength. The author also dealt with miscellaneous new materials for sealing against moisture, for cooling by an immersion medium, and for adhesive purposes.

In the next paper Messrs. R. E. Hall and E. Coop (both of the Signals Research and Development Establishment) described the present position regarding some components used in electrical instruments from the aspect of reliability and functional suitability under severe working conditions. Most of the components discussed were considered from the point of view of the Services, where a high standard of performance is required even under extreme climatic conditions. Details were given of the shortcomings of some of the present-day components and of the effort being directed to overcome them by the exploitation of new materials, new processes, improved design and better methods of manufacture.

In addition to the commonly used components, such as resistors, capacitors and transformers, mention was also made of a precision variable inductor. Other items dealt with included meters, electronic valves and quartz-crystal units.

The evening technical session was concerned with techniques in the field of radiation. In the first paper Dr. A. F. Harvey (Telecommunications Research Establishment) described the instruments used in the microwave band for the measurement of power, frequency and impedance. The majority of these use waveguide methods of transmission, but coaxial systems at the longer wavelengths and free-space semi-optical systems at the shorter wavelengths were also described. Emphasis was laid upon more recent instruments and on those for the millimetre wavelength region. Methods of

manufacture and their influence on behaviour and design were also discussed.

The introduction of electrical detectors into spectroscopy affects the design of spectrometers for use with them. This was discussed by Dr. A. C. Menzies (Hilger & Watts, Ltd.), who also considered infra-red techniques in some detail, since many of them are also employed in the other regions. Typical electrical methods of emission and absorption spectroscopy in the visible and ultra-violet regions were described and mention was made of a new type of photo-conductive cell for this part of the spectrum. The author said that scanning of Raman spectra was of particular interest, in view of the faintness of the signals. He also made brief reference to spectroscopy in the vacuum ultra-violet region.

The final paper of the conference, presented by Dr. D. Taylor (Atomic Energy Research Establishment) comprised a review of the techniques used in the detection and measurement of very-short-wave radiations (X-rays and gamma-rays) and nuclear and cosmic particles (alpha-particles, beta-particles, protons, neutrons and mesons).

The radiations and particles were classified under three headings: X-rays and gamma-rays, charged particles, and uncharged particles. In each case an account was given of the more important measurable quantities and physical basis of the method of measurement involved. The examples chosen to illustrate these techniques were process instruments developed at the Atomic Energy Research Establishment to provide continuous monitoring of alpha- and beta-activities in solution. In the alpha-activity monitoring instrument the pulse technique was used for recording individual particles, whereas in the beta-activity instrument the mean rate of ionization in an ionization chamber was measured as a direct current. Complete descriptions of both instruments were given by the author, together with details of the performance characteristics obtained.

The author concluded with a discussion of nucleonic-instrument design, and a number of aspects received special mention, namely source-detector geometry, detectors in assay instruments, special problems associated with portable instruments, and materials and finishes for radio-active-contamination monitoring instruments.

Consulting Engineers' Dinner

THERE was a large gathering for the annual dinner of the Association of Consulting Engineers at the Waldorf Hotel on 23rd May. Mr. R. W. Mountain, chairman, received members and their guests.

Mr. Richard Stokes, Lord Privy Seal, speaking as the principal guest, mentioned the great feeling of friendship and desire to co-operate which he had found during his recent visit to the United States. He said that one of our "problems" which other nations did not have was that there was no unemployment in this country. How woeful it would be if unemployment were caused by lack of materials. If this country had to go short of raw materials it would never be able to catch up. That fact was appreciated in America.

The provision of raw materials was not a short-term problem. When the "waste" of rearmament was done with it would be necessary for many years to come that all raw materials should be made fairly available to all parts of the world. That was an objective which could be greatly helped by engineers, particularly consulting engineers, whose main endeavour was to see that the customer had a fair deal and that was particularly important to customers abroad. Mr. Stokes expressed the hope that the independence, integrity and influence which had been characteristic of consultants would prevail.

Mr. Mountain, in responding, mentioned that the membership of the Association had increased appreciably. During the period of the annual report 90 nominations had been made, showing that there was an increasing demand for the services of consulting engineers. Mention was also made of the agreed "conditions of contract" for civil and for joint electrical and mechanical work which should materially help to get work done.

The toast of "The Guests" was proposed by Sir Peirson Frank who pointed out that the reduction of capital expenditure was preventing young engineers from the universities from acquiring practical experience. That effect must be guarded against. How could the Government expect to recruit more young engineers if work was not being done which enabled them to acquire practical experience?

Sir Edwin Herbert responded on behalf of the guests.

Commerce and Industry

Tin Research Laboratories

Power Engineers' Salaries

YESTERDAY (Thursday) H.R.H. The Duke of Gloucester opened the new laboratories of the Tin Research Institute at Greenford, Middlesex. The Institute originated in 1927 and is a unique example of international collaboration for research. The funds for the work are subscribed voluntarily by the mining organizations of various countries and the results of the researches are published and distributed free to all users of every nationality. The researches are mainly carried on at Greenford but certain work is entrusted to specialist laboratories both in England and overseas.

Visitors to the new laboratories yesterday saw for the first time a new electroplate "tin-nickel" which was discovered at the Institute. It is an alloy made by the simultaneous deposition of two parts of tin to one part of nickel. The electroplating process is simple and trouble-free and the coating is permanently brilliant under adverse outdoor conditions. The colour tone of the tin-nickel plate is a faint rose.

Tin-nickel was also shown as a decorative and protective finish upon a wide range of motor car and cycle accessories, tableware and cutlery, bathroom fittings, brush, comb and mirror sets, door and cabinet handles, locks and hinges, cigarette lighters and ash-trays. These items were sufficient to show that tin-nickel must be considered a serious rival to chromium.

In addition to tin-nickel there were seen five other alloy platings all invented in the Institute's laboratories. Other sections of the laboratories demonstrated their work on hot-dip tinning, soldering and the mechanical testing of tin alloys, including babbitt metals.

Diesel-Electric Locomotives for Ceylon

Eight diesel-electric shunting locomotives, built by the North British Locomotive Co., Ltd., in association with the General Electric Co., Ltd., are being supplied to the Ceylon Government Railway. The accompanying photograph shows one of the locomotives being shipped from Glasgow to Colombo. It is of the double four-wheel bogie type (Bo-Bo), with single cab, and has a starting tractive effort of 35,000 lb. The locomotive is powered by a Paxman 12-cylinder engine driving a G.E.C. combined main and auxiliary generator through a Wellman-Bibby flexible coupling. Automatic control of the generator field in conjunction with the engine governor ensures the maintenance of engine output over a wide range of loads and prevents overloading on any control notch. While intended primarily for shunting duties in Colombo goods yard, the locomotives may also be required to handle transfer traffic between the yard and the main line. The whole of the equipment has been designed to permit of long periods of service between refuelling and maintenance.

North British Locomotive Co./G.E.C. diesel-electric shunting locomotive being shipped from Glasgow to Colombo

E.P.E.A. Salary Claim

At last Wednesday's meeting of the National Joint Board for the Electricity Supply Industry the Electrical Power Engineers' Association put in a claim for a 15 per cent increase in the salaries of members employed by the British Electricity Authority and Electricity Boards. It was proposed that the increase should date from 1st July, 1951, and that no personal allowance or other excess payment made to a member of the staff governed by the N.J.B. Agreement should be reduced as a result of the increase in salary.

In a letter to the B.E.A. it was stated that the proposal was "based upon the effect which rising prices had had upon E.P.E.A. members, the need to maintain reasonable differentials as promotion incentives within the industry and within the Schedule and an equitable relationship

between the salary levels for technical staff and clerical staff, and the fact that the increasing complexity of engineering practice under modern conditions lays burdens upon the technical staff which are not adequately recognized by existing standards of remuneration."

Magnesium Licensing

Because of increasing defence needs an Order introducing a licensing system for the distribution and use of virgin magnesium and virgin magnesium alloys has been made by the Minister of Supply (Mr. George R. Strauss) and will come into operation on 11th June. The new Order (the Magnesium Distribution Order, 1951, S.I. 1951 No. 891) provides that any person proposing to acquire, treat, use or consume any magnesium of this kind must have a licence. This applies to stocks held at 11th June as well as to metal acquired subsequently. Steps have been taken to increase supplies, including long-term contracts with overseas suppliers and the re-opening of U.K. magnesium plants which were in operation during the war.

Tea-Making on Long-Distance Coaches

A fleet of auxiliary coaches is now being operated by Northern Roadways, Ltd., Glasgow, from Glasgow and Edinburgh to London non-stop through the night, and as there are no stoppages for refreshments provision is made to serve passengers with sandwiches and cups of tea during the journey. For this purpose a compact kitchen unit has been built into the rear of the coach to accommodate all the necessary utensils and materials. The provision of fresh boiling water for tea-making required special study as the only heating medium available was low-voltage electricity from the standard coach wiring circuit. To meet this special condition, James Stott & Co. (Engineers), Ltd., Oldham, in collaboration with H. Lee Burlingham and Co., of Blackpool, who were responsible for the building and equipping of the coaches, devised a novel arrangement consisting of a heavily insulated 4 gall urn with a draw-off tap and water gauge, fitted with a low wattage immersion-type element, arranged for operation on d.c. at 24 V. The urn is filled with boiling water from a Stott gas-heated "Magna" boiler at the bus station and the battery current is sufficient to maintain the water ready for use throughout the journey.

"Stott" urn installed in Glasgow-London coach to provide boiling water for tea brewing

New Brush Medical Centre

The reconstructed medical centre of the Brush Electrical Engineering Co. was recently officially opened. The centre has been rebuilt, with a facade of striking appearance, and with greater facilities for dealing with casualties and sickness.

The general layout of the new centre is simple and efficient. The private office of the medical officer (Dr. J. Magill Young) adjoins his consulting room. The first aid and casualty surgery, and the medical surgery are separate, and equipped with modern appliances; they

A casualty receiving attention in the new medical centre

are entered immediately from the waiting room. There is a separate apartment for lamp treatment and another for remedial exercises.

In addition to the medical centre each department has a voluntary first aid staff. The medical and first aid organizations, and appeals to employees, have reduced sepsis to practically negligible proportions. The medical service has resulted not only in raising the general standard of health of the company's employees to a high level, but has saved an incalculable number of working weeks for industry.

Ministry Acquires Elexcel Factory

It is announced that the Liverpool works of Elexcel, Ltd., the domestic electrical appliance manufacturers, has been acquired by the Ministry of Supply for other production purposes. Subject to material supplies remaining available, present orders will be executed and efforts will be made to ensure continued production of "Xcel" cookers and the supply of maintenance parts. Negotiations with this in view are already in hand, including the taking over of world-wide sales activities and specialist staff. The company's sales are said to have reached record levels recently, and it is the hope of the board that as little disturbance as possible will be created by the Ministry's acquisition of the works.

"Made in Tottenham"

In connection with Tottenham's Festival Fortnight (12th to 26th May) opened by Lord Morrison, the Eastern Electricity Board's Service Centre at High Cross, Tottenham, has entered the window dressing competition, the main feature of which is to display goods actually manufactured in Tottenham. In conjunction with Benjamin Electric, Ltd., the Centre has installed a range of modern lighting fittings, together with a selection of ancient lamps from the famous "George Herbert" collection, dating back to B.C. 600. Two special back panels refer to the "Darkness of B.C. 600" and "Light in A.D. 1951." The window is fully illuminated every evening; the colour scheme is cream, grey and maroon.

Tottenham Service Centre display

Copper Prices Raised

The Ministry of Supply announces that from 25th May the price of electrolytic copper has been increased by £24 from £210 to £234 per long ton delivered at consumers' works. Discounts and the forward purchasing arrangements announced by the Ministry on 1st May remain unchanged. Also from 25th May the Ministry's buying price for rough copper in slabs of from 2 to 3 cwt has been increased from £170 to £180 per ton.

Personnel Management

The Institute of Personnel Management has arranged a conference for overseas visitors at St. Catharine's College, Cambridge, from 26th to 29th June, on the general subject of "Personnel Management in Great Britain: Its Contribution to Productivity." The conference fee is £10 10s for visitors and £8 10s for Institute members. Particulars are available from the Conference Secretary at the Institute, Management House, Hill Street, London, W.1.

Early Chrysanthemum Blossoms

An exhibit that attracted a good deal of attention at the Chelsea Flower Show was that of Mr. John Bell, of Cross-in-Hand, Sussex, consisting of chrysanthemums which had been forced into flower by the application of electric lighting. The artificial lengthening of the short daylight hours of winter was achieved by the installation of tungsten filament lamps in dispersive reflectors controlled by time-switch. The great advantage of the arrangement from the grower's point of view was the fact that he was able to exhibit the flowers of chrysanthemum plants which he was offering for sale. Normally sales of plants can only be made

months after the customer has seen the blooms. The electrical equipment was installed by the Weald District of the South Eastern Electricity Board.

British Plastics Exhibition

The President of the Board of Trade, Sir Hartley Shawcross, K.C., is to open the British Plastics Exhibition in the National Hall, Olympia, next Wednesday. Sir Ben Lockspeiser, Secretary, Department of Scientific and Industrial Research, is to give the inaugural lecture on "The Place of Plastics in Industry" at the first session of the Convention at 4 p.m. on the same day. The Exhibition and Convention run concurrently until 16th June.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £124 0s 0d
COPPER, H.C. Electro	ton £234 0s 0d
Fire Refined 99·7 per cent ..	ton £233 0s 0d
Fire Refined 99·2 per cent ..	ton £232 10s 0d
LEAD, English	ton £161 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £1,145 0s 0d
ZINC, G.O.B. Foreign	ton £160 0s 0d
Electrolytic	ton £164 0s 0d
BRASS Tubes	lb 2s 0¼d
Sheet	lb 2s 3¼d
Wire	lb 2s 6d
COPPER Tubes	lb 2s 2¾d
Sheet	ton £284 10s 0d
H.C. wire and strip	ton £261 15s 0d
PHOSPHOR BRONZE	
Wire	lb 3s 7¼d
RUBBER, No. 1 R.S.S. spot ..	lb 43d–43½d

Trade Announcements

Dow & Nicholson, Ltd., are removing to more commodious premises at 10, Wellington Place, Aberdeen. The telephone number is unchanged (27435).

The **London Electric Wire Co. and Smiths, Ltd.**, and its associates, Frederick Smith & Co., the Liverpool Electric Cable Co., Ltd., and the Vactite Wire Co., Ltd., have removed their Bristol branch office to larger premises at 10, Narrow Quay; the telephone number is still Bristol 23753. They have also recently opened a sub-branch at Trinity Mews, Southernhay, Exeter (telephone, Exeter 55999).

The factory and offices of **Stewart Transformers, Ltd.**, are being transferred to more spacious premises at 75, Kilburn Lane, London, N.W.10, on 15th June.

Change of Name

The **Hardon Electrical Co., Ltd.**, has changed its name to Harris & Sheldon (Electrical), Ltd.

Catalogues and Lists

The Airscrew Co. & Jicwood, Ltd., Weybridge, Surrey.—Technical brochure on axial flow fans and catalogue of paddle blade fans.

English Electric Co., Ltd., Instrument Works, Stafford.—Technical brochure on polyphase watt-hour meters.

Howard Clayton-Wright, Ltd., Wellesbourne, Warwickshire.—Leaflet introducing the "Clatonrite" anti-vibration pipe and cable fixing clip.

Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham.—Illustrated folder on "Creda" heavy duty cooking equipment.

Stephen Glover & Co., Tudor House, Bridge Street, Walsall, Staffs.—Priced and illustrated catalogue of conduit fittings and wiring accessories.

Londex, Ltd., Anerley Works, London, S.E.20.—Illustrated brochure outlining the company's range of photoelectric equipment.

Sturtevant Engineering Co., Ltd., Southern House, Cannon Street, London, E.C.4.—Technical brochure (No. 2203) on industrial fans.

Wm. McGeoch & Co., Ltd., Warwick Works, Coventry Road, Birmingham, 10.—Catalogue and leaflet announcing a new range of lighting fittings, bulkhead fittings and switch assemblies.

Fluorescent Applications, Ltd., 13, Liverpool Gardens, Worthing, Sussex.—Leaflet introducing a patented fluorescent lighting system.

Brooks & Walker, Ltd., 41, Dockhead, London, S.E.1.—Illustrated folder announcing the "Diprofil" electrically operated hand filing machine which employs diamond and tungsten-carbide cutting tools.

NEXT WEEK'S EVENTS

Monday, 4th June to Friday, 15th June

LONDON.—Joint Engineering Conference. Simultaneous technical sessions at the Institutions of Civil, Mechanical and Electrical Engineers.

Wednesday, 6th June to Saturday, 16th June

LONDON.—Olympia. Business Efficiency Exhibition.

Olympia. British Plastics Exhibition.

Friday, 8th June

CAMBORNE.—Canteen Hall, Holman Bros., Ltd., 7.15 p.m. Institution of Mechanical Engineers (Western Branch). "The Applications of Atomic Energy Products in Industry and the Development of Nuclear Power," by Sir John Cockcroft. (Members of South Western Sub-Centre, I.E.E., invited.)

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

British Insulated Callender's Cables, Ltd.—Observing that sales in the early part of this year reached an exceptionally high level, Sir Alexander Roger (chairman), in his statement circulated with the report and accounts, adds that this involved drawing on the stocks of copper and certain other raw materials in their pipe-lines to execute orders accepted before rationing. From now on their sales must of necessity be geared to the materials made available to them for production purposes. Keeping their plant balanced on the present allocation of copper and other materials is becoming more and more difficult. Any further deterioration will bring about a serious position, while any improvement will ensure a steady load factor for some time ahead.

Dealing with the activities of the various divisions, he says that an outstanding feature was the successful expansion of the continuous vulcanizing plant which they have developed and which they are now supplying to several cable manufacturers at home and abroad under licence. In telecommunication cables, the demand for their new synthetic enamelled wire "Bicalex" has necessitated further expansion of their production capacity. Similar expansion is also the keynote of their manufacture of coaxial telephone cables. The total volume of production in the wire mill division last year was the highest ever recorded, but it is in this division that they are now feeling the most severe effects of the present shortage of materials.

The engineering division had another successful year. The disappointing feature of the year's production has been in l.v. power cables where they have been operating considerably below manufacturing capacity mainly because of the Government cuts in the capital expenditure of some of their principal customer groups in this country, and increased manufacture overseas, resulting in fierce competition for available business. The demand must at some time again increase, but for the moment it would appear that world productive capacity for l.v. power cables is in excess of requirements. Fortunately in its other activities their power cables division has been operating at a high level; the demand for super-voltage cables has been well maintained and new records established in the production of steel cored aluminium conductors.

With regard to the major replanning between their individual factories, it might be that the total schemes would be delayed because of the drastic cuts imposed on capital expenditure and for other reasons, but they will strive to go ahead with all their plans. During the past year the hitherto separate research and technical engineering organizations have been merged and building extensions have been completed at their Wood Lane research laboratories.

With regard to exports, he refers to their continued efforts to develop their markets and extend their manufacturing interests abroad, while mention is also made of important orders received from Canada in the face of intense competition. With the present acute shortages and the over-riding priority which must be given to defence requirements it is clearly going to be increasingly difficult to maintain their export achievements of recent years.

Johnson & Phillips, Ltd.—Presiding at the annual meeting held on 24th May Mr. G. L. Wates (chairman and joint managing director) said that 1950 opened with a full order book, but it quickly appeared that their customers were not ordering in the same volume as in previous years. This applied particularly to the cable department; the first six months showed a great recession in business. The second half of the year, however, was a period of much greater activity and orders came in at such a rate that delivery times again had to be extended. The Korean war and stock piling were contributory factors. At the end of the year they had more orders on their books by nearly a million pounds than in the previous year. The recovery came too late, however, to enable them to earn the same trading profit as in the previous year.

Their aluminium sheathed cable continued to be a bright spot in their story. Engineers were gradually becoming convinced that in certain positions and for the majority of uses aluminium had great advantages over lead and consequently demand for their cables was steadily increasing. This was not confined to Britain but applied all over the world. As he reported last year, they had now in hand, and had practically completed, a duplication of their aluminium sheathing plant so that, subject always to the raw material position, they would be able presently to double their rate of output.

Referring to the loss to industry as a result

of cuts in electricity, Mr. Wates criticized the restrictions imposed by the Treasury upon the capital programme of the British Electricity Authority, both in relation to generation and distribution.

Automatic Telephone & Electric Co., Ltd.—In a statement isued with the report the chairman, Sir Alexander Roger, says that although a high level of output has been maintained it was not sufficient to absorb the full productive capacity of their factories. This was mainly due to a temporary recession in exports and reduced Post Office orders for telephone plant and equipment. A further 1,000 persons could be employed if the Government were to permit the Post Office to place more orders in the current year. Only by long-term planning can the Post Office provide telephone service for the 450,000 persons on the " waiting list " of potential subscribers. This country has sunk to ninth place in the list of telephones per head of population and it is not merely a coincidence that those countries with most telephones per head of population are those with the highest standard of living.

Particular attention is still directed to the expansion of the company's activities in the field of radio and carrier telephony and telegraphy, and a large potential demand exists for the " Electromatic " system of vehicle actuated traffic signals. Attention is also being focused on the " Rythmatic " ripple control equipment. The subsidiary companies, Communications Systems, Ltd., and Hivac, Ltd., had both had successful years, but Elexcel, Ltd., made a loss due to restricted supplies of electricity, curtailment of the housing programme and scarcity of some raw materials.

Siemens Brothers & Co., Ltd.—After providing £497,527 (£276,895) for taxation, group profits for 1950 were £688,841 (£514,759). The ordinary dividend is maintained at 7½ per cent, plus a bonus of 2½ per cent (nil). Transfers to reserves from profit and loss account amounted to £320,874 (£377,462).

The Engineering & Lighting Equipment Co., Ltd., reports a profit for 1950 of £31,575, as compared with £16,477 for 1949. It is proposed to clear all arrears of preference dividend by a payment of 31½ per cent, representing 4½ years' dividend to 31st December last. It is also proposed to pay an ordinary dividend of 5 per cent. The previous ordinary payment was 8 per cent for 1946.

T. Clarke & Co., Ltd.—The consolidated accounts for the year to 31st December, 1950, show a group profit of £8,769 (£7,107), after taking into consideration U.K. income tax £12,905 (£8,655). The final dividend on the ordinary shares of 9 per cent less tax (against 5 per cent free of tax) makes 18 per cent less tax (10 per cent free of tax) for the year and £3,236 (£448) is carried forward.

The Power Securities Corporation, Ltd., reports a consolidated net profit of the holding company for 1950 of £141,625 (against £115,642). The ordinary dividend is unchanged at 6 per cent and £104,774 (£113,685) is carried forward.

The Atlas Electric & General Trust, Ltd., reports a gross investment income for the year ending 31st March amounting to £547,281 (£465,538), with other income totalling £11,507 (£13,019). After providing £239,070 (£196,766) for taxation, the net revenue was £261,145 (£223,217). The dividend is increased from 3 to 4 per cent.

The Calcutta Electric Supply Corporation, Ltd., record a gross revenue for 1950 amounting to £3,822,416 (£3,646,706). A final dividend of 3 per cent. tax free, is to be paid, again making 6 per cent. tax free, for the year, leaving £158,764 (£158,506) to be carried forward.

Crompton Parkinson, Ltd., have declared an interim dividend of 3¾ per cent actual on the ordinary and " A " ordinary stock.

Harland Engineering Co., Ltd.—The consolidated net profit for 1950 amounted to £74,267 (£51,113). Additional provision for deferred repairs and rehabilitation absorbs £2,000 (£2,500), plant replacement, research and contingencies reserve £18,000 (£8,000), general reserve £20,000 (£10,000) and pensions reserve £2,000 (nil). It is proposed to increase the ordinary dividend from 7 to 9 per cent, leaving £31,890 (£28,531) to be carried forward.

Liquidations

Electrical Services (Cowley), Ltd., electrical contractors, 496, Cowley Road, Oxford.—Liquidator, Mr. R. F. Bencall, 126, Colmore Road, Birmingham, appointed 8th May. Claims to be submitted by 30th June.

Cawnpore Electric Supply Corporation, Ltd.—Claims by 30th June to the liquidators, Messrs. A. L. B. Tucker and D. C. Wilson, Orient House, New Broad Street, E.C.2.

Bankruptcies

W. W. Brown, electrician, lately trading as " Lombard Electrical Wholesale Supplies," 64, Dagger Lane, West Bromwich. Receiving order made 16th May on a creditor's petition.

S. W. Morley, radio and electrical engineer, carrying on business as " Morleys," Bow Street, Rugeley, Staffs.—First and final dividend of 2s 4½d in the £ payable 8th June at 17, Albion Street, Hanley, Stoke-on-Trent.

STOCKS and SHARES

STOCK Exchange business is subject nowadays to fairly violent variations by reason of (*a*) foreign politics and (*b*) the domestic complications caused by shortages in so many directions. An unpleasant feature is the continued flatness of British Government and kindred securities. Until Monday in this week, no support was forthcoming to stem the continual stream of sales which went on, and the result of which was seen in a long string of falls during the month of May. Industrial prices on the whole have maintained their previous strength. Reference to the table on p. 1162 will show that the rises are in a substantial majority as compared with the falls in prices since a month ago. Dividend announcements are responsible in a number of cases for the fluctuations that have taken place. It may be mentioned, incidentally, that some of the prices on the next page are ex dividend as compared with this time last month, and the apparent fall is due, at any rate in part, to this factor.

British Electricity Stocks

International events seem to have put at least temporary obstructions across the flow of capital out of the gilt-edged market into industrial and commodity ordinary shares. Government stocks retain, however, a seriously debilitated appearance and show no obvious symptoms of returning vitality. Consol 4 per cents stand to yield 4 per cent, and the return on long-dated issues is approaching 3¾ per cent. That is, in fact, the redemption yield on 3 per cent British Transport stock 1978–88 at 84¼, allowing for the capital gain on final repayment at 100. On British Electricity 3½ per cents, redeemable 1976–79, the current yield at 96¾ has gone up to £3 12s 3d per cent, or £3 13s 9d per cent to redemption. The two 3 per cent issues, redeemable 1968–73 and 1974–77, are quoted respectively at 91 and 90¾, to yield approximately 3·3 per cent, or a few shillings more allowing for repayment.

Preference Shares

The rise in "undated" Government stocks towards a 4 per cent yield basis has inevitably pushed up further the return obtainable on preference shares. Many of these, as noted here last week, now pay better than their corresponding ordinary shares at prevailing dividend rates. For a well secured 4½ per cent return the investor has a fairly wide choice, which includes B.I.C.C. 5½ and 6 per cent preference stocks at 24s 6d and 26s 6d respectively, and Enfield Cables and Enfield Rolling Mills 4½ per cents, both at about par; G.E.C. 7½ per cent preference are offered at 30s 3d to yield nearly 5 per cent, and London Electric Wire 7½ per cents are quoted on the same basis. On the popular low-priced shares, such as Reyrolle "fours" at 18s 9d, yields are in the neighbourhood of 4¼ per cent.

Johnson & Phillips

It will be noticed from the above paragraph that a 4½ per cent yield is about the present-day basis for calculation in respect of good-class preference shares. Therefore the new Johnson & Phillips issue of 4½ per cent preference at 20s may be said to accord very closely with the current financial position, and, in the circumstances, it is not surprising that there should be no worthwhile premium on the shares. Dealings have started in the market on the basis of nil to 1½d premium; that is to say, if an allottee desires to sell, he would get no premium, while, on the other hand, anybody who desires to bring up his holding to a larger amount, would be called upon to pay 1½d premium over and above the issue price of 20s.

Siemens Dividend

After paying dividends of 7½ per cent without a break since as far back as 1936, Siemens Brothers are adding a 2½ per cent bonus to the distribution in respect of 1950. The price of the shares responded appropriately to the news with a rise of 3s to 40s. This was accompanied by a preliminary profits statement showing a further good expansion in that respect. At the new rate, the shares show now a round 5 per cent yield. Another company to announce a better dividend last week was the Atlas Electric & General Trust, which is raising the payment from 3 to 4 per cent. The price of the £1 shares is 19s.

Anglo-American Telegraph

The rise in the Anglo-American Telegraph preferred stock is due to a rumour which says it is hoped to remove the domicile of the company from this country to America. The object would be, of course, to escape the profits tax which precludes the payment of the full dividend on the 6 per cent preferred, and, of course, of the dividends on the deferred and ordinary stocks. So far, no official announcement has been made, but, from the rise which has taken place during the past month, it is apparent that there is at least a prospect of the report proving to be correct. Should it materialize, the present prices are too low. If there is nothing in the rumour, then it might be argued that the 6 per cent preferred will have to suffer a further cut in its nominal 6 per cent dividend, which is at present being paid at the rate of 5⅝ per cent. The Western Union Telegraph Company, which might be called upon to pay what expenses would accrue as a result of the move, might have something to say in the matter.

Electrical Investments

Past Month's Price Changes

Company	Dividend Pre-vious	Dividend Last	Middle Price May 25 1951	Month's Rise or Fall	Yield £ s. d.
Overseas Electricity Companies					
Atlas Elec. ..	3	4	19/-	—	4 4 3
Calcutta Elec. ..	6†	6†	23/9	—	5 1 0†
Cawnpore Elec. ..	—	—	28/9	—	Nil
East African Power	7	7	38/9	+⅛	3 12 4
Jerusalem Elec. ..	—	—	11/3	—	Nil
Madras Elec. ..	—	—	31/-	−2/-	Nil
Nigerian Elec. ..	10	10	31/3	—	6 8 0
Palestine Elec. "A"	5†	5†	19/6	—	5 2 7†
Perak Hydro-Elec.	Nil	Nil	12/6	−⅛	Nil
Whitehall Inv. Pref.	6	6	22/6	—	5 6 8
Equipment and Manufacturing					
Aberdare Cables(5/-)	20	20	14/6	−6d	6 18 0
Aron Elec. Ord. ..	15	15	40/-	—	7 10 0
Assoc. Elec. Ord.	15	20	97/6	+½	4 2 0
Automatic Tel.& El.	12½	15	70/6	+1/-	4 5 3
Babcock & Wilcox	15	18	80/-	+5/-	4 10 0
Baldwin, H. J.(2/-)	25	25	5/6	−3d	9 1 10
British Aluminium	10	10	45/-	+6d	4 9 0
B.I. Callender's ..	6¾	7½	37/-	+1/-	4 1 1
British Thermostat (5/-)	30	30	34/6	+6d	4 7 0
British Vac.Cleaner (5/-)	20	25	13/6	+6d	9 5 2
Brush Ord. (5/-) ..	10	10	7/-	−9d	7 2 10
Burco (5/-) ..	35	42½	23/3	+⅛	7 6 4
Chloride El. Storage	12½	15	70/-	−⅛	4 5 0
Cole, E. K. (5/-) ..	20	20	23/-	+1/6	4 7 0
Cossor, A. C. (5/-)	Nil	Nil	14/3	−9d	Nil
Crabtree (10/-) ..	17½	17½	43/-	+1/-	4 1 5
Crompton Parkinson Ord. (5/-) ..	22½	11½*	13/-	+6d	4 6 6
De La Rue (5/-) ..	50	50	35/-	+8/-	7 2 10
Decca (1/-) ..	112½	112½	23/6	−1/-	4 15 9
E.M.I. (10/-) ..	8	8	21/3	+3d	3 15 3
Electrical Components (5/-) ..	20	20	11/3	—	8 17 10
Elec. Construction	12½	15	66/9	+⅛	4 7 3
Enfield Cable Ord.	7½	7½	33/6	−4/-	4 9 7
English Electric ..	10	15	72/6	+3/9	4 2 9
Ericsson Tel. (5/-)	20†	22†*	53/9	+3/6	2 1 0†
Ever Ready (5/-) ..	35	35	33/-	+1/9	5 6 1
Falk Stadelmann	15	15	46/3	+⅛	6 10 0
G.E.C. Ord. ..	17½	17½	92/6	+6d	3 15 9
General Cables (5/-)	38	30*	17/6	—	6 11 6
Greenwood & Batley	15	15	55/-	+⅛	5 9 1
Hackbridge Cable (5/-)	—	20	14/9	−6d	6 15 7
HackbridgeHewittic (5/-)	12½	15	17/6	—	4 5 9
Hall Tel. Acc. (10/-)	10	10	15/-	−1/-	6 13 4
Heatrae (2/-) ..	12½	12½	4/-	—	6 5 0
Henleys (5/-) ..	20	20	24/-	−⅛	4 3 4
Hoover (5/-) ..	45	30*	31/3	+1/-	4 16 0
Intl. Combustion (5/-)	21	20*	23/-	—	4 7 0
Johnson & Phillips	15	15	60/9	−6/9	4 18 8

Company	Dividend Pre-vious	Dividend Last	Middle Price May 25 1951	Month's Rise or Fall	Yield £ s. d.
Equipment and Manufacturing (continued)					
Lancashire Dynamo	22½	22½	5½	+⅛	4 1 10
Laurence,Scott(5/-)	12½	12½	14/9	−1/-	4 4 9
London Elec. Wire	10	10	51/3	−1/9	3 18 2
J. Lucas	17½	6¾*	43/3	+2/-	3 1 7
Mather & Platt ..	11	12½	49/6	−6d	5 0 10
Metal Industries ..	10	10	45/6	+2/-	4 8 0
Mid. Elec. Mfg. ..	12½	15	62/6	+⅛	4 16 0
Murex	20	10*	57/-	+2/-	3 10 0
Newman Ind. (2/-)	10	6	3/-	−6d	4 0 0
Oldham & Son (1/-)	60	30*	5/-	—	6 0 0
Parsons, C. A. ..	15	15	97/6	+11/3	3 1 6
Plessey (5/-) ..	20	20	21/3	+1/9	4 14 1
Pye Deferred (5/-)	25	35	22/6	—	7 15 6
Radio & Tel. (2/-)	—	—	9d	−1½d	Nil
Revo (10/-) ..	27½	27½	47/-	+2/6	5 17 0
Reyrolle	15	15	84/-	+1/6	3 8 6
Scophony Baird(1/-)	—	—	1/4½	−1½d	Nil
Scot. Cable (4/-) ..	30	30	26/6	+6d	4 10 6
Siemens Ord. ..	7½	10	40/-	+3/6	5 0 0
Switchgear&Cowans (5/-)	20	22½	16/3	—	7 0 0
T.C.C. (10/-) ..	15	20	35/-	–	5 14 3
T.C. & M... ..	9*	10*	46/-	+1/-	4 7 0
Telephone Mfg.(5/-)	9	10	11/6	—	4 7 0
Thorn Elec. (5/-)	20	20	9/6	+9d	5 5 3
Tube Investments	25	25	6⅞	−⅛	3 12 8
Vactric (5/-) ..	Nil	Nil	11/3	—	—
Veritys (5/-) ..	5	2½	3/6	−3d	—
Walsall Conduits (4/-)	70	70	62/6	+⅛	4 9 6
Ward & Goldstone (5/-)	50	44*	44/-	+2/-	4 11 0
Watford (2/-) ..	20	25	8/-	+3d	6 5 0
Westinghouse Brake	14	14	61/3	—	4 11 6
West, Allen (5/-) ..	10	12½	12/-	−1/-	5 4 2
Transport and Communications					
Anglo-Am. Tel.: Pref.	5⅛	5⅛	78/-	+3/-	7 7 6
Def.	—	—	17½	+3	Nil
Anglo-Portuguese	8	8	26/-	−6d	6 3 1
Brit. Elec. Traction: Def. Ord. ..	50	32½*	535	+20	4 4 1‡
Cable & Wireless: Ord.	—	6	127½	—	4 14 1
4% Loan ..	4	4	100	+1	4 0 0
Calcutta Trams ..	6†	6†	26/9	−2/3	—
Cape Elec. Trams	6	4	16/-	—	—
Globe Tel. & Tel. Ord.	—	—	25/-	+1/-	—
Great Northern Tel. (£10)	7½	8	12½	—	6 9 0
Inter. Tel. & Tel.	Nil	15 cts	31	−1½	—
Marconi Marine ..	7½	10	36/6	+1/-	5 9 0
Oriental Tel. Ord.	16	16	55/-	+10/6	5 16 5
Telephone Props.	6	7	25/-	—	5 12 0
Tele. Rentals (5/-)	10	10	10/9	−9d	4 13 0

* After capital bonus.
† Dividends are paid free of Income Tax.
‡ Yield adjusted to capital bonus issue.

ELECTRICITY SUPPLY

South Eastern Tariff Revisions

"Gas Only" Decision Rescinded

FROM the first normal meter readings following 30th June revised tariffs are to come into operation in the area of the South Eastern Electricity Board. In an explanatory statement the Board points out that previous revisions during the past two years, in the direction of standardization, have been by way of reduction in the higher prices, but further standardization is not practicable without raising the lower prices. Had it not been for the increased cost of coal, wages and materials the Board could reasonably have hoped to continue towards uniformity by meeting the cost of reductions out of savings through reorganization carried out since the Board was established.

Under these revisions about half a million consumers will pay more (on the average ¾d a day, though the amount will vary greatly) and a similar number will continue at existing rates, while about 50,000 will pay less than at present. The alterations include the introduction of uniform flat rates for lighting (6d/kWh; prepayment 7d/kWh) and cooking, space heating and small power (1¾d/kWh); and standardization of the minium running charge under domestic and commercial two-part tariffs at ¾d/kWh. There will be a uniform charge of 5s/quarter for two-part tariff prepayment meters, while meter rents for credit two-part tariff supplies will be abolished. Cash discounts are to be withdrawn in the few places where they are at present offered. A large number of minor and complicated tariffs will be terminated and in some districts there will be introduced a new variable block tariff for commercial power supplies (initial rate 6d/kWh and then 1d/kWh), with an alternative three-part tariff in certain circumstances (annual service charge, annual demand charge, and "unit" charge of 0·7d).

Cooling Tower Modifications

The British Electricity Authority is to carry out alterations to Sunderland generating station cooling towers to prevent a continuous fall of fine spray. It is expected that the work will be carried out in August and September.

St. Lawrence Project

Premier Leslie Frost of Ontario indicated recently that if the Canadian Government decided to proceed on its own with the St. Lawrence Seaway, Ontario was prepared to enter into a joint scheme with New York State to develop the river's electric power. Nothing would appear to be gained by further delay. The Ontario Hydro-Electric Power Commission had all the basic plans for the power scheme ready.

Rural Supply Agreement

The Wellington Rural District Council has decided to reverse its previous decision to install only gas in new Council houses at Oake. Line rental proposals by the South Western Electricity Board which the Council previously rejected on grounds of expense and the likelihood of power cuts have now been accepted. They are estimated at about £4 to £5 per house with a reduction to about £2 where suitable

General view of the South Bank Exhibition showing screens in right background floodlit by "Mazda" projectors and in the foreground flower bowls lit by specially designed "mushroom" fittings

additional apparatus is installed. The Council will, therefore, be giving its tenants freedom of choice in the type of fuel used for household appliances. Credit is due to Mr. H. D. Weeks, the Board's Taunton District manager, for the successful completion of these negotiations.

B.E.A. Collier

William Pickersgill and Sons, Sunderland, have completed the 4,600 ton d.w. collier *W. J. H. Wood*, the last of six ships ordered from the company by the British Electricity Authority.

Tramway Abandonment

The last tram routes operated by the Gateshead and District Tramways Co., Ltd., are being replaced with motor buses this month. The only other North-East town where trams are still used is Sunderland.

Street Lighting

BLYTH (Northumberland) Town Council intends to make street lighting all-electric and is being recommended to spend £16,500 over a period of three years. It is proposed to install 255 sodium lamps.

WATFORD Borough Council Highways Committee recommends that application should be made to the Ministry of Transport for sanction to carry out the third section of the scheme for the provision of fluorescent lighting in High Street at an estimated cost of £1,200.

DARLINGTON Town Council has applied for sanction to borrow £1,210 for the provision of street lighting on the Haughton South site.

Sales Management Conference

London Chairman's Warning

"IN certain districts of London our distribution system is so heavily loaded that unless we can obtain more capital than has so far been allocated to us, we shall be forced in those districts, and for an indefinite period, to refuse to connect any new consumers—even though they are tenants of new housing estates." This statement was made by Mr. H. J. Randall, chairman, London Electricity Board, when opening the Electrical Development Association's annual Sales Management Conference at Caxton Hall, Westminster last week.

Even if there were unlimited funds and raw materials available for new generating stations and distribution systems there were not the necessary manufacturing and civil engineering facilities in the country to enable the plant shortage to be immediately overtaken. Unfortunately, and mainly because of the rearmament programme, there was now a shortage of money for capital purposes and also of the raw materials needed for new plant, cables and buildings of various kinds.

Power cuts were doing great harm to the goodwill which the electricity supply industry had built up over a long period of years; they were causing people to doubt the usefulness of electricity for the very many purposes for which it was pre-eminently suitable.

Unfortunately it was very difficult to educate the public in the true facts of the situation, and all kinds of false theories were spread and readily accepted. The electricity supply industry must keep the public properly informed about the plant shortage, the peak load problem and the electricity cuts. They must do their utmost, during the lengthy period of plant shortage, to ensure that the electricity available was used to the best advantage, and that people did not use apparatus which merely aggravated the peak load difficulties.

Finally they must aim to maintain the goodwill which had hitherto existed between electricity supply undertakings and their consumers, even though this became difficult in the face of the cuts and political propaganda.

The Conference concluded with the customary luncheon on Friday. It was held at the Connaught Rooms, London, and Mr. H. Nimmo (vice-chairman of the E.D.A. Council) presided. Mr. Nimmo explained that he was deputizing for Mr. C. T. Melling, the chairman, who was on his way back from the United States. He thanked the chairman of the Conference sessions and the authors of the papers which had been presented. Mr. H. J. Randall and Mr. Harold T. Perry, who had presented the first paper of the Conference, also made brief speeches.

Brazilian News

Exploiting Resources of the San Francisco Valley

From Our Rio Correspondent

THE San Francisco River flows for 1,800 miles from the mountains of Minas Geraes, in the centre of Brazil, to the Atlantic Ocean on the north-east coast. Navigation is interrupted by numerous falls and sandbanks, and one half of the river's course lies through a narrow valley, fertile and rich in minerals, but practically isolated from the rest of the country by high mountain ranges. A programme for exploiting the resources of the valley provides for regulating the flow of the river, in order to control floods, for clearing the channel, irrigating the dry lands of the north-east, and supplying electricity to facilitate the development of local industries. An enormous amount of material will have to be imported during the next five years.

Power Plant Construction

Dams and power stations are to be built at eight cataracts within the State of Minas Geraes, in order to make full use of a potential of 780,000 h.p. Work is to be started immediately on the Cajurú dam, which will hold 500 million cubic metres of water and supply the Bello Horizonte station with an additional 9,000 h.p. The cost of the project will be borne by the Minas Geraes Government, aided by a grant of £400,000 from the funds of the San Francisco Valley Commission.

The Fecho do Funil dam and power station will be built by a company formed for the purpose, on the lines of the "mixed" enterprise now constructing the 120,000 kW station at the Paulo Afonso falls, on the lower San Francisco. The company will have an initial capital of 600 million cruzeiros (£12 million), subscribed in equal parts by the Federal and State Governments. The dam will hold 1,000 million cubic metres of water and the work will be carried out in two stages, the first of which is estimated to cost £9 million. Negotiations have been proceeding for some months past in France and the United States to finance imports of the electrical material required.

Trade with Great Britain

Exports of electrical material from the United Kingdom to Brazil during the first six months of the new Trade Agreement (July to December, 1950) included telegraph and telephone apparatus, £45,906; parts and accessories for radio receivers, £320,102; electrical apparatus for domestic use, £9,575; unspecified electro-medical apparatus, £23,586; dynamo-electric machines, generators and similar, £172,307; electric motors, £77,092; dry batteries, £142,395; electric transformers over 2,000 kVA, £62,751; underground cables, £30,739; fittings for electrical installations, £44,598; electric meters, £16,166; electrical signalling apparatus (including railways), £13,833; refrigerators and accessories, £327,645.

In spite of the sterling shortage the value of exports from Great Britain to Brazil during the whole of 1950 reached £42,908,019, or £8,932,000 more than in 1949. Imports from Brazil totalled £44,315,867, leaving a balance of £1,407,848 in her favour. These figures, however, do not include exports of petroleum products, scheduled at £11,460,000 for the twelve months of the Agreement and paid for out of the sterling pool. Nevertheless the position has improved considerably. Bills outstanding at the end of the year amounted only to £8 million, and between 1st November and 31st January the Bank of Brazil was able to mobilize £33 million to pay for imports from the United Kingdom.

Miscellaneous Items

The Central of Brazil Railway has been authorized to import 200 electrical units, of three cars each, for its suburban lines at San Paulo, and fifty similar units for the Rio suburban lines.

The Brazilian Traction Light & Power Co., of Montreal, has announced a net profit of U.S. $33,222,001 for 1950, or $1,463,198 more than in 1949, equivalent to 6·07 per cent on the capital employed in Brazil. During the year the companies in this group invested a further $55 million on new installations and equipment in Brazil. The International Bank for Reconstruction and Development has granted the company an additional loan of $15 million, making $90 million in all, to improve the electricity supplies and telephone services in Rio and San Paulo.

The electrification of the Leste Brasileira Railway (Bahia) is proceeding rapidly. Two groups of 4,000 kW arrived from Switzerland early this year, and ten locomotives and three groups of cars have been ordered in the United States. The cost of the work, excluding rolling stock, is estimated at £2,400,000. The power station will use gas from the nearby Aratú wells, and will have a capacity of 20,000 kW, of which 15,000 kW will be absorbed by towns along the railway line.

The Radio Difusora de S. Paulo has been granted a concession to install a television station in San Paulo, to begin working within two years. This is the sixth television station authorized in Brazil during the past few months.

The National Carbon Company has obtained exemption from customs duties for material to be imported to manufacture dry cells and batteries in Brazil.

Spanish Electricity Production

Substantial Increase Last Year

AFTER the poor, and almost catastrophic, results of the last few years because of drought, the total electricity production in Spain last year was 7,500 million kWh, in which figure is included the production of the various small private and standby plants which for industrial users have lessened considerably the impact of the winter restrictions and cuts. The foregoing figure exceeds by 25 per cent the level reached in 1949, and surpasses the maximum of any previous year; it is made up of 5,400 million kWh from hydraulic and 2,100 million kWh from thermal installations.

The output from hydraulic stations showed an increase of 32 per cent over 1949, but in spite of this increase the results for 1950 have not reached normal compared with the capacity of the installations. Two of the six zones suffered again from prolonged drought, especially Andalucia, as a result of which considerable cuts were necessary in the first and last months of the year under review. These droughts have served to stress the utility of the mobile power stations of the type first supplied by the United Kingdom to the U.S.S.R., of which the Spanish authorities have purchased several during the last few years for the purpose of coping partially with local shortages. Three of these mobile stations, of 3,125 kVA, were transferred to Andalucia and the situation was further eased somewhat by a floating station of 5,125 kVA procured by the authorities in Italy and hurriedly transferred to Malaga.

The accompanying table compares the results obtained during the past three years.

During 1950 eight major new installations and extensions were put into service of which 32,000 kVA was thermal and 20,150 kVA water power. For the current year a much more ambitious programme has been planned: during the first six months it is expected to put into commission additions totalling 74,350 kVA, and during the second half of the year a further 168,950 kVA, making a total of 243,310 kVA. Of this total, 75,750 kVA will be in thermal stations and 167,560 kVA hydraulic.

Production	1948 Million kWh	1948 Percentage	1949 Million kWh	1949 Percentage	1950 Million kWh	1950 Percentage
Thermal ..	1,115	17	1,828	30	2,100	28
Hydraulic ..	5,459	83	4,159	70	5,400	72
Total ..	6,574	100	5,986	100	7,500	100

Electricity on the Farm

THE South East Scotland Electricity Board has just published a booklet entitled "Electricity on the Farm," which is available at all the Board's Service Centres for free distribution to farmers and others interested in farming. The booklet deals with a few of the many applications of electricity and provides information about the Service Centres and offices of the Board. Attention is drawn to the advisory service which is available to all interested in electrical equipment. The numerous photographs reproduced in the booklet illustrate a variety of installations in the South East Scotland Area.

Leicester Industries Exhibition

Industrial and Rural Displays

A MODEL dairy complete with pedigree attested British Friesians, together with milking, cooling, sterilizing, washing and bottling equipment, s a prominent feature of the Leicester, Leicestershire and East Midlands Industries Exhibition and Trade Fair which until tomorrow is being held at Granby Hall, Leicester. Among the electrical items of equipment demonstrated for which Perkins (Clean Milk Equipment), Ltd., is responsible are a two-unit portable milking plant, an 18 kW electrode boiler, a sterilizer, a churn steaming stool, a cabinet cooler and a chilled water plant.

Egg candling and automatic grading are demonstrated by Pepper & Co., Ltd., in another section of the exhibition devoted to poultry, where there can also be seen examples of Stephens' incubators (3,000 and 150 egg types) and a 400 chick electrically-heated battery brooder.

Specimens of various types of lamps and lanterns used for street lighting and other purposes make up an interesting exhibit prepared by the Leicester City lighting department. Methods of controlling the lighting in the city are to be seen and there is a series of cabinets indicating other uses of electricity and the ways in which light rays are refracted to suit the needs of street lighting.

Footwear manufacture being one of the most important of Leicester's industries, a comprehensive display of machinery for making cemented shoes is attracting a good deal of attention on the stand of Ralphs Shoe Machinery Co., Ltd. Other applications of electricity to industry, with special reference to mechanical handling, are represented by a number of exhibits. An automatic sack humper of novel design is shown by T. & T. Works, Ltd., while the Harborough Construction Co., Ltd., has on view both the "Harbilt" 670 rise and fall truck and the 685 low loader.

Machine tools and portable tools are a speciality of Lunts, Ltd., while the Midland Dynamo Co., Ltd., besides supplying all classes of electrical equipment, industrial and domestic, undertake installation work. For office use Gestetner, Ltd., shows duplicators, and Bransons (Office Equipment), Ltd., an amplifier for use with the standard G.P.O. or internal telephones.

Domestic appliances are represented by Hoover, Ltd. (vacuum cleaners and washing machines) and W. H. Smith & Co., who among their display of "Eziot" water heaters and urns have a prefabricated unit with built-in electric heater, single tap control and interceptor unit for hygienic glass washing purposes. Hot and cold cathode fluorescent lighting fittings are accompanied on the Neon Illumination Service (Leicester) stand by illuminated box signs, mains testing equipment, etc.

Unattended Transmitters

Equipment for Italy and Sweden

LOW-POWER broadcasting transmitters which can be left to operate unattended are among the latest Marconi developments to be ordered by foreign broadcasting authorities. Orders have recently been received from Italy and Sweden for ten and seven 2 kW models respectively.

This technique eliminates the need for skilled engineers to be constantly in attendance at transmitter sites. The transmitters are made up of units which are themselves complete transmitters, each having an output of between 500 W and 660 W. Three or four units in parallel are used to form a 2 kW installation and should a fault develop in any unit the transmitter switches itself off, tests itself, finds the unit which contains the fault, and switches the good units on again while isolating the faulty unit. This complete cycle takes only two to five seconds. Remote control is achieved by the use of one pair of high quality lines.

Each of the units measures only 2ft 6in by 2ft 6in by 7ft and has no rotating mechanism or oil immersed components. They use the minimum of valve types and the output valves can withstand long periods of 100 per cent modulation. Any one unit can be serviced while the others remain in operation, and the circuits are divided on to chassis which can be withdrawn and easily carried by one man. They can also be rack-mounted in a maintenance van.

A day-to-day stability of one in ten million is maintained and two crystal drives are provided—one as a spare which is automatically switched into circuit should the working drive fail.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (2s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1946

37431. Burgess, A. F. (Parker, L. W.).—Television receivers. 19th December, 1946. (655153.)

1947

13897. Anglocentrop Industrial & Rural Craft Co., Ltd., and Karolv, P.—Methods and means for the recording and reproduction of sound. 23rd May, 1947. (655159.)

23691. Igranic Electric Co., Ltd.—Control systems for electric motors. 27th August, 1947. (655036.)

25280. Standard Telephones & Cables, Ltd., and Outram, L. J.—Electrical mixer circuits. 10th September, 1948. (655037.)

27756. Philips Electrical, Ltd.—Methods of and means for accurately positioning electrodes and like objects one within another. 16th October, 1947. (655163.)

27819. Compagnie Générale de Télégraphie sans Fil.—Electronic discharge tubes applicable to ultra-short waves. 17th October, 1947. (655164.)

30822. British Thomson-Houston Co., Ltd.—Magnetrons. 20th November, 1947. (655041.)

31831. British Thomson-Houston Co., Ltd.—High-frequency electrical discharge apparatus. 2nd December 1947. (655044.)

1948

917. British Thomson-Houston Co., Ltd.—Projection television receivers. 12th January, 1948. (655166.)

1369. Standard Telephones & Cables, Ltd. (International Standard Electric Corporation).—Telecommunication switching system. 16th January, 1948. (Addition to 624557.) (655058.)

1394. Western Electric Co., Inc.—Piezo-electric crystal bodies. 16th January, 1948. (655073.)

1846. Philips Electrical, Ltd.—Electrical amplifying circuits. 21st January, 1948. (655167.)

5501. Marconi's Wireless Telegraph Co., Ltd., and Grisdale, G. L.—Variable electrical filters. 28th October, 1948. (655083.)

6350/1. Chilowsky, C.—Method and apparatus for producing electrical and mechanical energy from thermal energy. 29th February, 1948. (655087/8.)

6553. Philips Electrical, Ltd.—Modulated-pulse multiplex signalling systems. 2nd March, 1948. (655193.)

8857. British Thomson-Houston Co., Ltd.—Resistance units for electric circuit-breakers. 25th March, 1948. (655111.)

9544. Ericsson Telephones, Ltd., and Sinclair, W.—Printing or recording apparatus. 2nd April, 1949. (655113.)

9902. Bendix Aviation Corporation.—Echo ranging apparatus. 8th April, 1948. (655196.)

10636. Philips Electrical, Ltd.—Circuits for producing a saw-tooth current. 16th April, 1948. (655174.)

11004. Radio Corporation of America.—Direct current re-insertion circuits for television apparatus. 21st April, 1948. (655197.)

11341. Compagnie des Freins et Signaux Westinghouse.—Means for varying and measuring ultra-short electromagnetic waves propagated in a wave-guide. 26th April, 1948. (655176.)

11838. Siemens Bros. & Co., Ltd., and Long, D. P.—Electrical impulse counters. 29th April, 1949. (655119.)

12671. Hoover, Ltd.—Electric hand irons. 7th May 1948. (655120.)

15207. Sylvania Electric Products, Inc.—Electrical coating for discharge devices. 11th June, 1948. (655125.)

17417. Hazeltine Corporation.—Control system for adjusting a first voltage toward equality with a second voltage. 29th June, 1948. (655187.)

22182. Philips Electrical, Ltd.—Electric discharge tubes. 23rd August, 1948. (655216.)

24916. Philips Electrical, Ltd.—Automatic frequency control systems. 23rd September, 1948. (655141.)

25149. Imperial Chemical Industries, Ltd., Howell, W. N., and Hill, H.—Electrolysis of fluorine salts. 27th September, 1949. (655098.)

25496. Philips Electrical, Ltd., Holmes, T., and Gosti, A. W.—Mercury vapour discharge lamps. 30th September, 1948. (655145.)

25561. Cork, E. C.—Electrical wave band pass circuits. 13th September, 1949. (655146.)

25807. British Thomson-Houston Co., Ltd.—Control of electric cooking ranges. 4th October, 1948. (655100.)

26219. A. C. Cossor, Ltd., and Fleming-Williams, B. C.—Radar apparatus. 20th September, 1949. (655148.)

26936. Marconi's Wireless Telegraph Co., Ltd.—Electrical oscillation generators. 16th October, 1948. (655102.)

26949. T. Price & Son (Stampers), Ltd., and Price, E. E.—Electric short-time switches. 17th October, 1949. (655225.)

27747. Fkg. F. Kesselring Geratebau Akt.-Ges., Ekkers, G., and Farner, A.—Thermomagnetic starters for electric discharge tubes, in particular fluorescent lamps. 25th October, 1948. (655104.)

29240. Westinghouse Electric International Co.—Electronic oscillation generators. 10th November, 1948. (655234.)

29490. Thermionic Products, Ltd., and Angold, E. B.—Sound recording apparatus. 11th November, 1949. (655106.)

30379. Electrolux, Ltd. (Aktiebolaget Elektrolux).—Covers and latching assemblies for containers and particularly for vacuum cleaners. 23rd November, 1948. (655107.)

30917. British Thomson-Houston Co., Ltd.—Casings for elastic-fluid turbines. 29th November, 1948. (655235.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 16th June:—

INTEGRITY (design). No. 693,076, Class 9. Radio and television receiving and transmitting apparatus and parts included in Class 9 of all such goods; and combined reflecting and mechanical signs.—David Wallace, Ltd., 154, Strand, London, W.C.2.

CONYCLAD. No. 694,171, Class 9. Insulated electric wires and cables.—Connollys (Blackley), Ltd., Blackley, Manchester.

MAGNEGRAPH. No. 696,028, Class 9. Magnetic sound recording apparatus.—Magnegraph Recording Co., Ltd., 38, Hanway Street, London, W.1.

VELVARC. No. 697,144, Class 9. Electrodes for electric arc welding; and electric arc welding apparatus (not being machines) and parts thereof included in Class 9.—Arc Mfg. Co., Ltd., 52A, Goldhawk Road, W.12.

LIGHTFOOT (design). No. 697,032, Class 11. Refrigerating apparatus and parts thereof not included in other classes.—Lightfoot Refrigeration Co., Ltd., Abbeydale Road, North Circular Road, Wembley.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Australia.—BRISBANE.—4th July. Single-phase and three-phase outdoor transformers; Wh meters with m.d. indicators; ammeters; voltmeters, etc. (C.R.E. (I.B.) 61430/51. Ten/2481.)*

18th July. Alternators for the Longreach, Barcaldine and Blackall Shire Councils. (C.R.E. (I.B.) 61071/51. Ten/2462.)*

3rd August. City Council. Supply of 200 kVA distribution transformers. (C.R.E. (I.B.) 60956/51. Ten/2467.)*

SYDNEY.—12th July. Sydney County Council. 66 kV arc suppression coil. (C.R.E. (I.B.) 60207/51. Ten/2430.)*

Belfast.—22nd June. Electricity Department. Cranes, boiler feed pumps and circulating water screening plant for Victoria power station. (See this issue.)

Halifax.—19th June. Corporation. Re-electrification of Sunnyside Schools. (See this issue.)

India.—MADRAS.—Government Electricity Department. Closing date for the receipt of tenders for switchgear and power transformers for substations for the Tungabhadra hydro-electric scheme extended to 21st August. Certain amendments have also been made. (C.R.E. (I.B.) 58360/51. Ten/2337B.)*

Ireland.—3rd September. Electricity Supply Board, Dublin. One 30 MW turbo-alternator, condensing plant, etc., for Ringsend power station. (See 25th May issue.)

Oswestry.—15th June. Borough Council. Improved lighting on the Swansea-Manchester Road. (See 25th May issue.)

South Africa.—SPRINGS.—27th July. Town Council. Seven 5,000 kVA transformers together with earthing accessory plant. (C.R.E. (I.B.) 61442/51. Ten/2475.)*

Swinton and Pendlebury.—18th June. Borough Council. Rewiring lighting and power installations at Victoria House, Swinton. (See this issue.)

Tangier.—21st June. Bureau de Telefonica de Tanger S.A. Lead-covered cables. (C.R.E. (I.B.) 60972/51. Ten/2486.)*

West Hartlepool.—Town Council. Electrical installation at "Hollymount" residential nursery. Borough architect, Municipal Buildings.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

ORDERS PLACED

Devizes.—Corporation. Street lighting columns and lanterns and incidental works in various classified roads (£6,520).—G.E.C.

Durham.—County Education Committee. Electrical installations in schools:—Newton Aycliffe New County (£2,284).—W. Sykes & Sons, Darlington. Stockton New Technical College (£13,640).—Watson-Norie, Ltd., Newcastle-on-Tyne.

Grimsby. — Corporation. Recommended. Electrical installations at Highfield Grammar School for Boys (£12,162).—N. G. Bailey & Co.

London. — BATTERSEA. — Borough Council. Electrical installation work at Rollo Street housing scheme (£7,590).—Holliday, Hall & Stinson.

Scarborough.—Town Council. Passenger lift at Town Hall buildings (£1,108).—Keighley Lifts, Ltd.

Stockton-on-Tees.—Town Council. Installation of electricity in 50 houses, Roseworth site (£1,388).—W. Stewart & Son, Stockton.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aylesbury.—Hostel for aged persons (£25,000), Walton Street; county architect, Buckingham.

Barnet.—Extensions to Queen Elizabeth Grammar School, for Herts C.C.; Yeomans and Partners, builders, 41, Upper Berkeley Street, W.2.

Bath.—Houses (44), Freeview Road site; J. Owens, city engineer, Guildhall.

Cambridge.—School of veterinary medicine at the University (£250,000); I. Forbes, architect, 3, Weighhouse Street, London, W.1.

Coalville.—Houses (80), Greenhill estate; U.D.C. surveyor.

Colne.—Stage 1 of Colne Valley School; J. Wimpenny & Co., Ltd., Milnsbridge, Huddersfield.

Consett.—Long-term plan for developments at Richard Murray Hospital (£80,000) for Newcastle Regional Hospital Board, "Dunira," Osborne Road, Newcastle-on-Tyne.

Coventry.—Flats (108), Sadler Road site; city architect.

Cumberland.—Adaptations at Englethwaite Boys' Home (£11,161); E. C. Coleman, Cragg Howe, Lyth, Crosthwaite.

Dagenham.—Factory, Hainault industrial estate, for Baker's Joinery, Ltd.; M. F. Pratt, Ltd., builders, 28, Nightingale Lane, E.11.

Derby.—Flats (40) and houses (20), Louvain Road; borough architect.

Doncaster.—Extensions to factory, Wheatley Hall Road; Roxeth Wallpapers, Ltd.

Dorking.—Factory, Vincents Lane; E. J. Baker & Co., Ltd., High Street.

Douglas (I.O.M.).—Houses for Borough Council: McCormick & Davies, Ltd., Willaston estate, Douglas (116 houses) and J. M. Clarke, Palatine Road Works, Douglas (46 houses).

Durham.—Administrative block for proposed fire brigade headquarters; county architect, Court Lane, Durham.

Essex.—Primary schools at Layer Road, Colchester (£94,810); Romford (£105,100) and Harrington Road, Leyton (£95,950); H. Connolly, county architect, County Hall, Chelmsford.

Hull.—Factory premises; Burstall & Dodds, Ltd., 81, Freehold Street.

Cinema; Hull Cinemas, Ltd., The Criterion, George Street.

Ipswich.—Additions to Luther Road School (£26,661); Sadler & Sons, builders, 81, Richmond Road.

Kenton.—Junior school, Clifton Road (£50,800) for R.C. authorities; Ealand & Pierce Developments, builders, Westfield Drive, Kenton.

Kidderminster.—Factory extensions, Springfield Lane; Kidderminster Textile Co., Ltd.

Lancaster.—Flats (40), Hala estate; F. W. Nelson, Common Garden Street.

Leeds.—Erection of Adel (Low Farm) C.P. School; N. B. Bell & Co., Ltd., Frankland Terrace.

Houses (224) in ten contracts; city architect.

London.—Warehouses, Jamestown Road, N.W.1. (£200,000); W. & A. Gilbey, Ltd., Oval Road, N.W.1.

BERMONDSEY.—Rebuilding cold storage warehouse, Crucifix Lane (£58,000); Chamberlain Industries, Ltd., builders, Staffa Road, Leyton, E.10.

WANDSWORTH.—Flats (68), nursery school, etc., Clapham Crescent site; Gough Cooper & Co., builders, Church Hill, Wilmington, Kent.

Loughborough.—Works extensions (£63,800); Herbert Morris, Ltd., lifting machinery makers, North Works, Meadow Lane.

Manchester.—Flats (111), Cambridge Street and Newcastle Street, Hulme; city architect.

Newbury.—Houses (104), Chandos Road; E. A. Bance & Sons, Ltd., Ball Hill, East Woodhay.

Northumberland.—Headquarters for the C.C.'s fire brigade at Morpeth; county architect, County Hall, Newcastle-on-Tyne.

Nottingham.—Study-bedroom block at Nottinghamshire Training College; Wm. Moss & Sons, Ltd., builders, Queens Road, Loughborough.

Ormskirk.—Houses (40), Scotts estate; E. J. Wright, U.D.C. surveyor, Burscough Street.

Penge (Kent).—Flats (38), Trenholme estate; U.D.C. surveyor, Town Hall, Anerley Road, S.E.20.

Peterborough.—Operating theatre, ante-natal clinic and nurses' accommodation at Gabb's Maternity Home; Hoare, Lea and Partners, consulting engineers, 23, St. James Road, Birmingham.

Portsmouth.—Factory; McMurdo Instrument Co., Ltd., 145, London Road, Kingston-on-Thames.

Port Talbot.—Primary school, Cymmer; L. R. Gower, architect, Glamorgan County Hall, Cardiff.

Rawtenstall.—Erection of Waterfoot Nursery School for Lancs E.C. (£27,743); Ashworth & Hobson, Ltd., Rawtenstall.

Rugby.—Church of England Secondary School (£108,000); J. B. Surman and Partners, architects, 16, Harborne Road, Birmingham.

Runcorn.—Houses (105), Town Hall estate, for U.D.C.; W. E. Jones, Middlewich.

Salford.—Flats (20), Eccles Old Road, for Booths Charities, Ltd.; Halliday and Agate, architects, 19, John Dalton Street, Manchester.

Salisbury.—Houses (42), Pauls Dene estate; Brazier & Son, Ltd., 303, Portswood Road, Southampton.

Salop.—Colleges for further education at Oswestry and Wellington; county architect, Shrewsbury.

Spalding.—Two pumping stations for Deeping Fen, Spalding and Pinchbeck Internal Drainage Board; E. G. Taverner, engineer, Deeping House, Welland Terrace.

Stockport.—Houses (94) at Brinnington estate; J. C. Darley & Co., Ltd., Manchester.

Stoke-on-Trent.—Aged persons' hostel, Mill Farm estate, Chell Heath; city architect.

Sutton Coldfield.—Bungalows (32), Hollyhurst Road; King Street Self Building Housing Society, Ltd., 40, Aston Brook Street, Birmingham.

Flats (26) and maisonnettes (52), Falcon Lodge estate; borough surveyor.

Houses (30), Halton Road; Allton Estates, Ltd., 658, Chester Road, Erdington, Birmingham.

Swanage.—Houses (50), Erston site; U.D.C. surveyor.

Swansea.—Factory on site at Waunarlwydd; Imperial Chemical Industries, Ltd., Metals Division.

Tipton.—Houses (24), Roberts Field site; Baker Bros. (Builders), Ltd., Upper Gornal, Dudley.

Tonbridge.—Houses (60), Cage Farm estate; S. J. Thorne, clerk, Tonbridge Castle.

Wembley.—Factory extensions, Wycombe Road; Abbey Plating Co., Ltd.

West Ham.—Nine shops with flats above, Fife Road; borough architect, 70, West Ham Lane, E.15.

Whitby.—Houses (30) on various sites; H. J. Stanworth, R.D.C. surveyor.